THE MARINE ENGINEER,

A MONTHLY JOURNAL OF

MARINE ENGINEERING, SHIPBUILDING,

AND

STEAM NAVIGATION.

EDITED BY WILLIAM GEORGE NEAL, ASSOC. I.N.A.

Vol. VII.—From April, 1885, to March, 1886.

London:
OFFICE FOR ADVERTISEMENTS AND PUBLICATION, 3, AMEN CORNER,
PATERNOSTER ROW, E.C.

1886.

INDEX.

EDITORIAL NOTES.

ILLUSTRATED ARTICLES.

GENERAL INDEX.

OBITUARY.

LETTERS TO THE EDITOR.

BOOKS REVIEWED.

PATENTS.

PARAGRAPHS, NOTES AND NOVELTIES.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.

Vessels not Named.

TRIAL TRIPS.

Not Named.

Printed for the Proprietor by H. Blacklock & Co., 75, Farringdon Road, in the County of Middlesex, and Published at the Office, 3, Amen Corner, Paternoster Row, in the parish of Christ Church, in the City of London.—March 1st, 1898.

The Marine Engineer.

LONDON, APRIL 1, 1885.

EDITORIAL NOTES.

IT is somewhat derogatory to our credit as an engineering nation that the breakages of large propeller shafts at sea still continue to be so comparatively numerous. On the average we believe the breakdowns amount to something like two or three every year. The breakdown of the *Poonah* s.s. only a few weeks back is a striking instance of the kind, where many lives are put in jeopardy through an accident which marine engineers seem to put up with as more or less inevitable. For our part we cannot see why a propeller shaft should be more vulnerable to a breakdown than any other part of the mechanism of the engine, and it would seem to be an easy thing, even were such breakdowns to be looked upon as unavoidable, to provide a connection in the propeller shaft, which should determine where the point of fracture should take place, and which might thus be rendered easy of repair. There are so many ways in which the fracture of propeller shafts may be guarded against, that it is a matter of surprise to us that none seem to have been generally adopted. The interposition of a spring coupling, easily made and designed, between the propeller and the engine, would go far to obviate any risks of fracture likely to arise from a sudden shock upon the propeller shaft. Similarly, since we may presume that when the fractures do take place they are occasioned by a sudden shock to the propeller shaft, probably arising from the racing of the propeller in bad weather, it is a wonder that governors should not be more generally adopted in the Navy and Mercantile Marine, such as would absolutely prevent all risk of racing. This can only be of the type which depend for their operation upon the rise of the propeller or stern of the vessel out of the water. Such governors do however exist, and would no doubt be an absolute preventative against the danger of the propeller shaft racing. Again, it is highly probable that in most cases of fracture of propeller shafts there exists a more or less serious flaw in the shaft, due to burning whilst forging, or imperfect welding in the case of wrought iron shafts. This may be avoided by the employment of a more reliable and homogeneous material, such as the homogeneous fluid compressed steel produced by Sir Joseph Whitworth. Or it may be that the vibration to which propeller shafts are subjected tends to destroy the fibrous quality of that which was once tough and reliable wrought iron, and which thus has become crystalline and brittle. Against both these defects, namely, hidden flaws, or change of structure, there are known precautions. The presence of flaws can be detected by electrical methods of investigation in the same way as faults are ascertained in telegraph cables; and similarly the change of structure under vibration, to which we have referred, is a known danger to railway axles, and danger from this cause is prevented by a proper annealing of the axles at suitable intervals. We should be exceedingly obliged to our readers and correspondents if they would keep us advised, from time to time, as to the particular and probable cause of such breakdowns, as we might therefrom deduce valuable results for the protection of others. As far as we know, no reliable data are accessible as to the most general causes of the breakdown of propeller shafts, nor do we know of any experimental test being employed to ascertain from time to time the satisfactory or other condition of propeller shafts that have run for some years.

OUR shipyards will be having now some cause for self-congratulation upon the numerous contracts for the building of iron-clads, cruisers, and torpedo boats that are being placed among private firms by the Government under the popular pressure now experienced for a more satisfactory state of the Navy. We are glad to see that the late Committee presided over by Lord Ravensworth seem to have been instrumental in producing a great improvement in the conditions under which such Government contracts are entered into with private firms. By those personally interested it is well known that great expense, delay, and trouble have been caused by the practice of the Admiralty in preparing imperfect drawings and specifications for the work that has to be contracted for. The result has usually been that the completion of any part has been subject, from time to time, to the arbitrary decision of the Government overseer, this being an eminently unpractical and unsatisfactory way of conducting business. We now see that Lord Northbrook, although he seemed annoyed with the interference of the said Committee, reported in the House of Lords that the matter had received attention at the Admiralty, and that the drawings and specifications are now prepared in such a way that they might be worked to without constant application to the Government overseer. This is as it should be, the proper function of

an Admiralty overseer being simply an inspection of material and workmanship to specification, rather than an irresponsible and autocratic designer of the method of carrying the work into execution. We should recommend shipbuilders who are desirous of cutting into Government contracts to pay particular attention to the production of high speed torpedo boats and light cruisers. There is here much scope for the individual ingenuity of firms to produce boats and light vessels which will develop the maximum speed with the least weight and greatest storage capacity, and we firmly believe that modern navies of the future must necessarily consist of a very much larger proportion of torpedo boats and cruisers than has hitherto been the case. The production of high speed torpedo boats has hitherto lain almost exclusively in the hands of one or two firms, who have devoted special attention to the latter; but we think that the demands upon the private producing power of our shipyards will be at once very largely increased, and that there will in this department be excellent opportunities for private firms to secure good contracts.

THE mariners of the last generation must be very much put out and annoyed by the constant introduction of mechanical methods for carrying on the ordinary duties of the vessel, thus substituting the engineer's duty very largely for that of the able seaman. We do not seem by any means to have yet reached the climax of a scientific seagoing steamer, which shall be as independent as possible of human labour for the direction of its movements. Steam steering-gear under the direction of a single officer or mate, and thereby substituting the force of half-a-dozen men at the wheel, has now ceased to be a novelty. The lighting of our splendid ocean liners from stem to stern with electrical lamps, turned on into full action in an instant of time, and the firing of broadsides from our heaviest ironclads by the closing of an electrical circuit under the control of a single officer, are now matters of general adoption and everyday occurrence. Electrical signals of endless variety have been suggested, and to some extent adopted, from vessel to vessel, and from officers to engineers and men in different parts of the vessel; but we only the other day heard of a new application of electricity on board ship, which seems to cap all that we have before referred to, and to be another step forward towards an automatic self-propelling vessel, almost imbued with the power of reason and self-control. The improvement we refer to is the employment of a compass which shall automatically control the course of the vessel. By the employment of electricity a movement of the slightest kind and of the most gentle character, such as that even of a compass needle, may be utilised to close circuits on either side of its normal position, and thus to set in action electrical force of any desired magnitude, which may be applied to the control of a steam steering-gear, and thus eventually to the control of the ship's course. The compass of the vessel has merely to be set by the officer of the watch to a certain course, and the needle will automatically keep the vessel in a bee-line upon that course without the intervention of any man at the wheel, unless cause should exist for the diversion of the vessel from its direct course. This idea, we should say, will prove valuable in the prevention of a good deal of bad steering, and thus the maintenance of an accurately true course shall be no longer subjected to the irregularities of individual steerers; but a good and steady look-out must be kept to avoid obstacles or other vessels.

WE think that the present public scare as to the state of the Navy is likely to produce considerable modifications in the Administration of the Navy. Nor are such changes likely to occur before they are wanted. It stands to reason that where all the conditions of construction of our modern ironclad navy are so entirely different from those of the last generation, and alter so rapidly from day to day, that young and enterprising blood is required to push such changes and enterprises to a prompt and practical conclusion. The appointment of Mr. Rendel some time ago to the Admiralty Board was the first symptoms of the proper recognition of this want, but we do not think that this step was nearly sufficient to meet present requirements. As naval administration is most certainly a national rather than a party question, we think that the leading executive might well be vested in a permanent official, chosen with care from the leading spirits of the day in naval re-organisation, and who could thus represent the motive power on the Board, held properly in check and subject to the advice and experience of the more strictly naval members of the Board. It must not be forgotten, as we so often insist, that the battles of the navies of the future will be fought by the engineers and their scientific appliances rather than by pure seamanship as heretofore, and it is absurd not to recognise this change of basis most fully before dire disaster has shown the folly of not doing so. We see that Mr. W. H. Smith, M.P., who speaks with the force of practical experience of the Admiralty Board, is most energetic in pressing these views upon Parliament,

and advocates further the appointment of an independent external committee to inquire into the whole administration of the Navy. Such an enquiry cannot at least do any harm and may do a great deal of good, as nothing is more dangerous than the supineness of ignorance.

We wonder why "hot draughts" have never been exhaustively experimented upon in the Navy or Mercantile Marine. With the high speeds now required from the lightest possible weight of boilers in the light cruisers and torpedo boats, any apparatus that will increase the evaporation of a boiler ought to be readily welcomed. As an instance of this we need only point to the success attending the adaptation of a forced draught to such boats and fast steamers. This is merely with the view of increasing the consumption of fuel per square foot of grate surface, without reference to the economy of evaporation attending such consumption. In fact, such forced combustion is usually accompanied by more wasteful expenditure of fuel than occurs under the more natural circumstances of an ordinary draught. The great difficulty in the application of a hot draught to a boiler has existed when such draught depends upon the natural flow of air being determined by the difference in the specific weight of the hot air of the issuing draught and of the external cold air. The artificial heating of the draught would in such case probably so seriously interfere with the normal draught that more would be lost than gained by such an expedient. Where, however, a forced draught is produced by a fan or other mechanical appliance, this objection ceases, and we think a very marked effect upon the economy of evaporation might be produced, with also a great increase in the combustion per square foot of grate area. As to the economy of evaporation so producible, a few broad facts may be of service in directing the intelligent attention of our readers to the matter. Every pound of fuel consumed upon a grate requires practically at least 18 to 20 lb. of atmospheric air for its proper combustion, and this enormous mass of air has to be raised from its ordinary atmospheric temperature to that at which it escapes from the up-take or funnel at the expense of the fuel. As this latter temperature is frequently from 300 to 500 degrees Fahrenheit, the wasted heat thrown away up the chimney would represent at least 25 per cent. of the whole heat developed by the furnace. If, however, the air were supplied to the furnace at a temperature nearly equal to that at which it was allowed to escape, without special demand upon the fuel, it is evident that the wasted 25 per cent. of heat would be recovered. This is simply the principle of "regeneration," as has already been so successfully applied in the Siemens' gas furnace and in hot air engines, the heat of the waste hot gases being utilised to develop the heat in the incoming fresh charge of cold air. All such small improvements in economy and the increased rate of combustion will, in the aggregate, produce a marked effect upon the success of our Navy and Mercantile Marine, now so dependent for improvement upon the ingenuity of the Marine Engineer.

CONDENSED WATER FOR THE SUAKIN EXPEDITION.

THE steamer *Cyphrenes*, owned by Messrs. C. W. Kellock & Co., being the sixty-second vessel chartered by the Government in connection with the military expedition to Suakin, and the construction of a line of railway between that port and Berber, left the Mersey on March 19th for her destination. The *Cyphrenes* is one of four vessels to be stationed at Suakin with the express object of converting salt water into fresh for the use of the troops, and also to feed the locomotives employed on the railway. During the process of condensing, the water is to be passed into reservoirs on land in a condition fit for immediate use, whilst the supply for the railway will, by the adoption of an American invention, be forced to various stations along the route. The speed with which the *Cyphrenes* has been equipped for her special purpose, under instructions from Capt. Brownlow, C.B., superintendent of transports, is something extraordinary. The charter was completed on the 6th instant, and Messrs. Kellock placed the vessel in the hands of Messrs. Laird Brothers, of Birkenhead, who immediately brought the resources of their vast establishment to bear upon the work. Within a little over a week two boilers were placed in the forehold as a special means of supplying steam to the condensers, the vessel was lined on both sides with tanks, and the condensers themselves were securely fitted up about amidships on the lower deck. It may be mentioned that as the *Cyphrenes* will be lying stationary at Suakin, the main boiler may be used to facilitate the work of condensing should occasion require, so that ample power is available. The apparatus used is the "Acme" patent water condenser, patented and manufactured only by Messrs. A. B. Fraser & Co., 77, Regent-road, Liverpool, which has gained the highest approval of eminent authorities, and the despatch in fitting out the *Cyphrenes* could not have been accomplished had not Messrs. Fraser & Co. been able to supply eight of those condensers at a week's notice. The special features of the "Acme" condenser are the formation and jointing of the annular chambers or tubes. As these tubes are corrugated, the greatest surface is thereby obtained in the smallest space, while the corrugations serve to break up the volume of steam, and also baffle the water passing through the condenser, thereby gaining the fullest surface benefit, and moreover allowing of expansion and contraction without injury to joints at end of tubes. Each condenser is fitted with ærating appliances, and is furnished with a filter, so that the supply of fresh water is reliably pure, and fitted for immediate use. Amongst other advantages the "Acme" condenser occupies comparatively small space, and can be easily taken to pieces and put together again with unskilled labour. Messrs. Fraser & Co. have supplied the *Cyphrenes*, as stated, with eight of these condensers, which combined are capable of converting the enormous quantity of from 250 to 300 tons of salt water into fresh per day, at a temperature of 64 degrees. Tests in order to prove their efficiency were made on March 17th and 18th before Mr. Inglis, chief engineer of H.M.S. *Phæton*, and Capt. Smith (representing the Admiralty), with the most satisfactory results. The fact that the *Cyphrenes* was thoroughly equipped on such short notice proves that the resources on the Mersey for an undertaking of this nature are, on an emergency, quite as ample as those available in the south of England. The work executed by Messrs. Laird is, as usual, of first-class description. The vessel has been fitted with special engines and fans for ventilating the stoke holes and the ship throughout.

THE ENGLISH NAVY.

MR. NATHANIEL BARNABY, C.B., the Director of Naval Construction, has lately issued his first annual address to the Royal Corps of Naval Constructors. The document deals fully with recent naval controversies. He says:—

The year 1884 has been remarkable from the point of view of the naval constructor for some very successful speed trials. The following may be noted:—

Name of ship ..	Umbria.	America.	Riachuelo.	Esmeralda.	Collingwood.
Date of trial ..	Oct., 1884	June, '84	Feb., '84	July, '84	May, '84
Displacement ..	12,000	9,550	5,700	3,000	8,150
Load on safety valve	110	95	90	90	90
Natural draught:					
No. of revolutions	70	65	91·7	No trials	89
I.H.P.	13,000	8,000	6·926	nat'l.	8,369
Speed	19·25	18·25	16·25	draught.	16·6
Forced draught:					
No. of revolutions	—	—	93·65	123·29	95·57
I.H.P.	Nil	Nil	7·336	6·083	9·573
Speed	—	—	16·75	18·35	16·84

The full power with natural draught will probably not be realized again. The forced draught has the great advantage that it may be always reckoned on for giving very nearly the full power.

2. The difficulties attending the steering of the *Agamemnon* have created much attention. In order to understand the question it is necessary to notice the peculiarities of the ship.

—	Dreadnought, as designed in 1872 and completed.	Agamemnon.
Length	320ft. 0in.	280ft. 0in.
Breadth	63ft. 10in.	66ft. 0in.
Mean draught of water	26ft. 9in.	23ft. 6in.
Displacement	10,820 tons	8,510 tons
Thickness of Armour ... Hull ..	14in., 12in., and 11in.	18in. and 15in. in two thicknesses.
Thickness of Armour ... Turret ...	14in. in two thicknesses	16in. and 14in.
Armament	4 38-ton guns	4 38-ton guns. 2 81-cwt. 6-inch.
Coals carried	Normal 1,200 tons; can carry 1,485 tons	Normal 700 tons; can carry 900 tons.
I.H.P.	8,210	6,360.
Speed	14¼ knots	13 knots.

In April, 1882, after some preliminary trials of machinery, in which the steering power of the ship did not give satisfaction, we proposed to add a false keel, increasing the mean draught to 24¾ ft., and the extreme draught to 26 ft., deepening the rudder 2 ft. It was, however, thought better not to give up the advantage of lightness of draught until trials at sea had shown it to be necessary. The reports of the officers of the Steam Reserve at Chatham, and the experience of Captain Long in the Channel, caused the latter officer to say, on leaving England, that he should certainly avail himself of the permission given him to have the rudder increased at Malta. But before leaving he had fitted, with the assistance of Mr. Froude, an automatic tell-tale to the rudder. On the passage to Gibraltar this was applied to the hand gear and the steam gear in successive hours, with the following results:—

	Hand.	Steam.
Number of times moved in the hour.. ..	29	88
Period during which the helm was steady amidships	Minutes. 13½	Seconds. 42
Maximum angles of helm each way	Deg. 12	Deg. 20

Captain Long reported thereupon that the ship did not need further steering power, but appeared to require additional keel to secure steadiness on a course, without having to use the helm for maintaining it. After some further experience it was decided at Malta that the ship was perfectly under command, and that when drawing 26 ft. aft she steered as well as other ships in the fleet.

There have been remarks about the fulness of the lines of this ships, and as to their having some obscure effect upon the steering. The Torquay experiment, made in connection with the design, showed that the lines are not ill-suited to a speed of 13 knots, which was the *maximum* speed laid down as one of the conditions when she was designed. This fulness of form was certainly necessary where so much was attempted on a length of 280 ft., and a mean draught of 23½ ft. There was supposed to be much to be said in favour of still wider proportions at the date of the design of the *Colossus*, but other counsels prevailed, and the lengthened *Agamemnon*, *i.e.*, the *Colossus*, had altogether avoided difficulty in steering, while it has given much higher speed with the same engine power.

3. Recent debates in the Press and in Parliament on the relative strength of the English Navy were opened in the *Pall Mall Gazette* with much ability and fairness. There has been considerable misstatement and exaggeration in the course of the inquiry, and there are many points of great interest which have not been touched, or if they have been the naval officers who have touched them have preferred to dilate upon questions of naval construction. We have seen, for example, an Admiral of the Fleet giving the names of ships stripped to "an alarming extent" of their belt armour, and declaring that they are most dangerous, and including among them the *Conqueror* and the *Hero*. He informs the public at the same time that the *Warrior* and the *Black Prince* are completely belted. This Admiral had the *Warrior* under his command in the Channel Squadron in 1870, and was superintendent of the dockyard, where the contrary of that which he states as to these ships must have been clear wherever they came into his hands.

Purely naval questions which might be discussed with advantage are the relative strength of the *personnel* of the English Navy—first, in ships armed and always available; and, secondly, including all the reserves. France has in armed commission ships in a time of peace 15,000 men, against the 22,000 of England, and she has inscribed on her rolls 170,000 seamen, while in England, including all reserves, there are not 100,000. There is another pressing question. It may be to the interest of France to build large battle-ships, and not at all to the interest of England to do so. The differences in the duties to be performed by the fleets, and in the character and training of the men, justify such a question. The only advice given by the Admiral of the Fleet is, "Imitate the the vessels of every class in her Navy," "and merely double the numbers."

Again, all the elder naval authorities and statesmen insisted on maintaining the power of examining neutral ships and confiscating enemies' goods in them. In 1856 this was surrendered informally, and privateering was at the same time abolished. Although it has never been formally ratified, all the European powers, except Spain, have put their hands to a declaration to this effect. The United States was willing to agree, if private property of all kinds at sea were made secure against capture, whether under a neutral or under a hostile flag. Cannot some definite agreement be come to on this important question? It affects in a most vital manner the question as to what kinds and numbers of ships are required for national defence.

Such questions as these are, I say, left almost untouched by naval officers. The outcome of the debate has been a decision to build by contract a number of new ships. It will have been seen that none of them are of types which have been tried at sea. We are almost as bad as the French. They never repeat a type which has been actually tried. The development of the armament is so rapid that, by the time a ship is tried some imagined combination presents superior attractions to those found in any actual ship. The inference I should myself draw from this rapid change of fashion is that very large ships should be produced slowly; and those classes should by preference be increased which possess, in speed, in coal endurance, and in weapons, the power of attacking the largest ships, by concentration, while the sudden foundering of such ships by the attack of the ram and torpedo would be far less disastrous to the fleet to which they belonged.

Sir Edward Reed hopes to meet the attack of the ram and the torpedo by armour-plating the inner bottom. Personally I have no faith in this plan for our Navy, although I have recently had the opportunity of seeing it worked out most ably by him. The true defence for us against the increasing power of the underwater attack lies, I believe, in numbers of ships. The very heavily-armed battle-ship has, I consider, only a subordinate part to play—that of preventing in enemies' ships an extension of armour proof to light guns. What we most want is well-armed and fast ships, having their buoyancy assured by a belt, or by an equivalent deck. As to the absolute strength of the Navy, I entirely concur with those who desire that it shall be twice as powerful as that of France. The question is, how can it be made so, and particularly is it right to devote our chief attention to piling up dead material in large ships?

4. In order to place in a clear light the question of the extension of the belt to the ends of ships, I enclose a comparative statement made for the purpose:—

TYPICAL ENGLISH BATTLE-SHIPS, BUILT AND PROPOSED, HAVING UNARMOURED ENDS.

NAMES.	Percentage of water-line area covered by armour.	Percentage included in coal-bunkers beyond the armour.	Percentage of enclosed cork chambers.	Remaining percentage.	Percentage of cubic contents of spaces in last col. occupied by stores, excluding coal and cork spaces.	Buoyancy lost by complete riddling of unarmoured ends.	Total sinkage of ship corresponding.	Displacement.
						Tons.	In.	Tons.
Warrior	60	None	None	40	17·5	850	32	9,210
Resistance	59·25	None	None	40·75	17·5	780	42	6,270
Inflexible	42	30	11·4	16·6	25·4	750	23	11,880
Agamemnon	45·4	18·5	12·85	23·25	24·5	580	22	8,510
Colossus...	42·75	26·85	12	18·4	22·8	570	18	9,150
Collingwood	54·15	17·4	None	28·45	22·6	500	17·5	9,150
Camperdown	56·35	17	None	26·65	21	420	14	10,000
Conqueror	96·15	None	None	3·85	10	34	1¼	6,200
Last approved design for single turret ship	60·4	17	None	22·3	21	380	11·5	10,300
Belted cruiser	84·85	None	None	15·15	10	41	2	4,900

In order to justify the stoppage of belt armour short of the ends, we consider it desirable to provide an unusually large metacentric height in the intact ship, to provide against loss of it by perforation and water-logging. That there is no serious disadvantage in this in respect of rolling is shown by the behaviour of the *Inflexible*, where the effect of great metacentric height in quickening and accumulating angles of oscillation is compensated for by the large *inertia* of the wide and heavy citadel, and is reduced by other means. When the French Naval officers recognise this new condition of things, and no longer fear the heavy rolling they have been accustomed to find invariably associated with a high metacentre, they will probably prefer to accept the better protection of their guns or a reduced size of ship. The latest designs of M. de Bussy, the author of the *Redoubtable*, *Devastation*, *Foudroyant*, *Tonnerre*, *Tempête*, &c., provided for a central citadel with the usual proportions and metacentric height of ships and with thin armour at the ends of the belt proof to the quick firing guns. It is conceivable that some such provision against machine guns might be a wise addition where weights can be surrendered to meet it. In the *Agamemnon*, for example, 2 in. armour could be put in a belt 6 ft. wide, with the weight of less than one-third of her ammunition for her turret guns, of which she carries 180 rounds, while the *Admiral Baudin*, of over 11,000 tons displacement, carries only 66, and the *Duperré* and *Devastation* 76. That it cannot be right to continue armour of anything like the *maximum* thickness to the ends of the belt, if the question of the behaviour of the ship with high metacentre is once put aside, will be clear from the following considerations:—(*a*) There are existing guns capable of perforating the best armour which can be made 19 in. thick, supported by a far stronger backing than is ever given in a ship. The three targets fired at recently at Spezia—targets built in this manner—were all wrecked by the shot; (*b*) there is no French ship built or building in which the barbette or turret armour reaches this thickness. In the *Admiral Baudin* the barbette armour is 16½ in. (*c*) The way in which the complete belt draws upon the other armour may be seen by the following comparison:—

Alternative designs, with same displacement.	Single turret, as approved.	Same ship, with belt extended and thinned.	Increase in ship if armour not thinned in middle and made 12in. at ends.	Alternative for this increased size, with 14 in. armour, not carried to ends.
Length	335 ft.	335 ft.	355 ft.	355 ft.
Breadth	70 ft.	70 ft.	70 ft.	70 ft.
Speed	15½	15½	15½	15½
Displacement ...	10,000	10,000	11,000	11,000
Belt...	Shortened	Complete	Complete	Shortened
Thickness on belt	18 in.	14in. to 12in.	18 in. to 12 in.	14 in.
Other armour ...	18 in.	14 in.	18 in.	14 in.
Armament ...	1 turret, 2 110-ton guns	Same.	Same	Two turrets 2 110-ton guns, 2 43-ton guns
Battery for small guns	Aft covered with 3-in. armour	Same.	Same	Amidships with armoured traverses only

(*d*), in the *Agamemnon*, where the armour is mainly iron from 18in. to 14in. thick, and where the armament is nearly confined to the two turrets, any reduction of its thickness would have to be faced in view of the fact that the shot which wrecked the Spezia targets is estimated to be capable of perforating 40 in. unbacked iron armour. It may be proper to add that the reversion to the shortened belt is due to the recommendation of the Committee on Designs, in 1871, although they are in no wise responsible for the manner in which it has been carried out. I ought perhaps to say something about the charge of undue slowness in building. I do not intend to defend it, because I believe that more rapid building would be far better, especially as a question of cost per ship. But one cannot refrain from reminding oneself that the men who complain are those who paralyzed the ironclad building in the years 1872-4 when we ought to have been building unmasted ships of the *Devastation* type. The spurt in 1868-71 produced ironclad shipping (by aid of two large votes of credit) much in excess of the 12,000 tons regarded as the nominal requirement. The debates in Parliament and in the Press on the loss of the *Captain* and on the danger of the *Devastation* type caused a loss of ironclad tonnage in 1872-74 exactly equivalent to the excess in the previous years. For the discredit thrown on the *Devastation* type at that time—most unfairly as it now seems—no men were more responsible than Lord Henry Lennox, Admiral Sir John Hay, and Admiral Sir Thomas Symonds. They were supported for two years by almost the entire Navy, and the class of ship had no friends outside the walls of the Admiralty until after the *Devastation* had made her sea trials in 1874-5. As this was most undoubtedly the most promising type of ship which could be produced, to discredit it was to stop all progress in armoured shipbuilding. Stated generally the causes of slow progress are:—1. The money voted by Parliament provides for a given number of tons of armour-clads each year; if this will just build the equivalent of two ships in a year, and it is desired to build each ship in three years, it will follow that not more than six ships should be in progress together, but as a matter of fact twice that number are often found in progress together by order of Parliament. 2. With so many ships in progress, delays in the settlement of questions of armament and alterations are submitted to, and men are withdrawn and sent to other ships, thus spreading the money and the tons built over twelve instead of six ships, greatly increasing the cost per ship and halving the rate of building.

BRITISH SHIPS.

A RETURN has lately been issued by the Board of Trade pursuant to an order of the House of Commons, moved for by Mr. Rathbone, of the losses of British ships and their crews or passengers in the years 1880-1-2. The return, which only deals with ships of more than 250 tons of gross registered tonnage, is divided into three parts. The first deals with the cause of loss; the second with the nature of the cargo of the lost vessel; the third shows to what port the vessel was bound, and in what trade it was engaged.

From the first table we find that in the three years mentioned the total loss of British ships was 1,167, and of the lives lost with them, 5,028. Of these totals 830 are set down as sailing, 337 as steam vessels. Though, as it will be seen, the sailing vessels lost are nearly as 2·5 to 1 of the steam, there is a greater equality in the number of lives lost, which were 2,837 and 2,191 in the sailing and steamships respectively. Thus it may be reckoned that while on an average 3·5 lives are doomed for every sailing vessel that is lost, a steamship carries 6·5 lives to the bottom with it. As to the cause of loss, stranding is most fatal to ships, 392 sailing and 199 steam being set down under this head. Abandonment and foundering take 184 and 41 respectively. There were noted as missing 114 and 38 respectively of the two classes; but though these numbers are not so high as those of the two former heads, the loss of life in this class is very considerably higher. Thus, while in sailing vessels 572 lives were lost through stranding and 207 through abandonment and foundering, no fewer than 1,910 lives were lost in missing ships of this class. The total of deaths in steamships differs in proportion, but the number set down as missing, 912, is greater than either the 831 under stranding or the 349 under abandonment and foundering. It may be noticed that the number of lives lost with each sailing vessel missing is on an average 16, with a steamer 24; also that an abandoned sailing vessel causes on an average the loss of hardly more than one life, while a steamer so wrecked loses eight. Under the head of collisions the nnmber are 27 and 46; under that of fires, 45 and six respectively. The column devoted to explosions is fortunately

a blank—that is, no vessel of either kind is known to have perished from this cause.

The second and third tables we give at length:—

2.—NATURE OF CARGOES.

—		Grain.	Coal.	Timber.	Metals and Metallic Ores.	Guano.	Phosphate Rock.	Nitrate of Soda.	Salt.	Sugar.	Petroleum.	Cotton, Wool, and Jute.	Esparto Grass.	Other Cargoes.	Mixed Cargoes.	General.	Ballast.	TOTAL.
Sailing	Vessels Lost	60	190	140	40	7	16	10	17	30	19	8	5	53	59	63	113	830
	Lives Lost	389	642	457	51	11	78	40	68	155	64	73	5	137	221	221	225	2,837
Steam	Vessels Lost	44	78	6	35	—	1	—	—	5	—	6	—	9	36	89	28	337
	Lives Lost	341	488	1	142	—	—	—	—	22	—	26	—	50	275	841	5	2,191
TOTAL	Vessels Lost	104	268	146	75	7	17	10	17	35	19	14	5	62	95	152	141	1,167
	Lives Lost	730	1,130	458	193	11	78	40	68	177	64	99	5	187	496	1,662	230	5,028

3.—VOYAGES OR TRADES.

—		Baltic (including the Cattegat).	Black Sea and Mediterranean.	Other European Ports (i.e., not in the Baltic, Black Sea, Mediterranean, or United Kingdom, Home, and Coasting Trade).	Other African Ports (i.e., not in Mediterranean).	British North America (East Coast).	British North America (West Coast).	United State of America (East Coast).	United States of America (West Coast).	Other American Ports (East Coast).	Other American Ports (West Coast).	India and other Asiatic Ports (including the Malay Archipelago).	Australia and New Zealand.	United Kingdom, Home, and Coasting Trades.	TOTAL.
Sailing	Vessels Lost	27	35	4	37	112	4	180	33	119	64	120	56	39	830
	Lives Lost	63	82	21	46	245	3	541	245	217	186	878	192	118	2,837
Steam	Vessels Lost	39	67	39	7	20	—	38	1	15	—	44	13	54	337
	Lives Lost	170	446	120	250	47	—	264	25	46	—	388	210	225	2,191
TOTAL	Vessels Lost	66	102	43	44	132	4	218	34	134	64	164	69	93	1,167
	Lives Lost	233	528	141	296	292	3	805	270	263	186	1,266	402	343	5,028

The figures in these tables include British ships registered in the colonies as well as in the United Kingdom.

STEAMERS ON THE NILE.

THE chief engineer of the Yarrow stern-wheel steamer *Lotus*, who left Korti February 17th, gives an account of the remarkable voyage of his vessel to that place from Semneh, which shows the fitness of this kind of craft for the navigation of a river so difficult and dangerous at all times, but especially when the stream is low, as the Nile. With a light draft of only 18 in., a flat bottom, and stability gained by a breadth of beam (18 ft.) proportionately great for her length, which is about 75 ft., the boat passed without injury up the long and almost continuous series of rapids and cataracts between Semneh and Abu Fatmeh, a distance of over 200 miles by the river. What proved of greatest moment in the behaviour of the steamer was the rapidity with which she answered to the wheel and the action of the twin rudders. This perfect manageableness, which Mr. Stanley found in an equal degree in a Yarrow boat of the same type now running on the Congo, it will be readily understood is of the first importance in the navigation of a tortuous and swift stream with a rocky bed. The steersman placed forward on the over deck can, with a single turn of the wheel, so instantaneous is the action of the balanced rudders, avoid a sunken rock, and it is noticeable that the good steering qualities of the boat are not less marked when the engines are reversed and she is going astern. If it is remembered that nearly all the steamers which have been wrecked on the Nile between Semneh and Khartoum have been lost in coming down stream, the value of these characteristics of the stern-wheel Yarrow steamers will be appreciated, for there can be little reason to hope that, even with high Nile, the dangers will be much diminished, although extreme lightness of draught may cease to be an essential condition.

The *Lotus*, or, as it was officially called, Yarrow boat No. 1, was sent out in sections or pieces of easily movable dimensions, the heaviest indivisible portion of the machinery being the large paddle-wheel shaft. This, which weighed about 6 cwt., had to be slung on poles between two camels when land transport was necessary. The difficulties of one kind and another proved so great, however, that it was decided to put the *Waterlily*, the second boat of this type, together at Alexandria. This was done under the superintendence of Mr. Broadmeir, one of Messrs. Yarrow's engineers, a young German, who has had some experience of these boats on South American rivers. He took the *Waterlily* to Wady Halfa, making the quickest run on record from Cairo to Assouan. The Nile was too low, however, for the steamer to pass the second cataract, and the *Waterlily* has since been employed in running between Wady Halfa and Philæ. The work of putting together the *Lotus* had been in part carried out, when the engineer in charge, Mr. C. C. Wigg, fell sick of gastric fever, and was invalided home. Mr. Broadmeir then directed the work on the *Lotus* until the boat was ready for the voyage. She was placed under the command of Lieutenant Stanhope, R.N., who had ten or a dozen blue-jackets with him, Mr. Broadmeir, two engineers, and four stokers. There were four Canadian voyageurs, of whom two left the boat at Dal. They also had the services at times of Nubian pilots. For fuel wood was used, logs and old pieces of timber from wrecks of nuggars or other waste being picked up occasionally. There are large stores of coal at Assouan, and at other points on the lower reaches of the Nile, but all the available transport service having been employed in the forwarding of ammunition, provender, and stores for the troops, the coal supplies were not accessible. It is intended to make arrangements for wood stations, if the natives can be induced to bring wood suitable for fuel from the interior.

Leaving Semneh on January 2nd, the first serious difficulty was encountered at the succession of rapids forming the Ambigole Cataract, where the stream has a fall altogether of about 10 ft., lengths of broken water intervening between the four gates, which have, one after another to be passed through. Of these the last offered the most serious difficulties. The water, pouring over a rock near the middle of the river, has hollowed out a cavity in the rocks below, and over this hole, which has been deepened by the constant circular action of the pebbles, there is a strong whirlpool. Above this perilous spot ledges of rock jut out from the banks on either side, and between them the stream pours in a rushing torrent athwart the bed of the river. At first an attempt was made to pass up to the left of the whirlpool, 300 Egyptian soldiers, in equal parties on either bank, hauling at the hawsers, and the engines working with full steam on. When, however, the bows caught the full force of the cross current above the rock in mid-stream, the stern was swung round, and the vessel was saved only by her instantaneous obedience to the reversed action

of the wheel, which brought her astern and out of harm. It was then deemed advisable, in order to avoid risk of life, to take the crew off and to haul the vessel through without steam. Three hawsers were used, manned by 700 Egyptian soldiers. The three ropes broke at the critical moment, and for a few minutes the steamer was left at the mercy of the stream. At last she was got through in safety, and with but one dent, which was of no importance. Progress under such conditions was necessarily rather slow. They called at the military stations, of which there are twelve from Wady Halfa up to and including Dongola, taking instructions and occasionally stores. They had to stop whenever they saw a chance of obtaining any wood for fuel, and before it became suddenly dark, or about 6 o'clock in the evening, wherever they happened to be, they made fast to the bank for the night, starting again at about 8 in the morning. On January 12th, they were at the Lower Tanjour cataract. This system of natural weirs has, like that of Ambigole, four gates or passable waterways in the successive ridges over which the river falls. They ran to bank, and examined what was literally the ground they had to get over, for there was very little water and a great deal of rock. Having decided upon their course, they got up steam and tried to take the first gate. They very nearly succeeded, but when halfway over they stuck, poised in the rapid, and had to fall back. Another hawser was run out, and a second rush proved successful. "The whole time we were passing this cataract," Mr. Broadmeir says, "it felt just as if we were going overland, the steamer bumping and scraping on the stones for 20 minutes." How severe this trial of the strength of the boat was may be inferred from the fact that the floats of the wheel, which do not go so deep as the bottom of the hull by 4 in., were actually knocked in towards the centre of the shaft to the extent of 3 in. There were, as may be supposed, many dents, but there were no holes. A better proof of the wisdom of using a tough and elastic material like steel for vessels on this service, instead of wood, could scarcely be given. These long, light, shallow boats, with the weights of the machinery divided by placing the boilers in the fore part and the direct-acting engines near the wheel at the stern, are so braced by the use of steel rods to take any strain, after the method of constructing a suspension bridge, that it may be said Messrs. Yarrow have devised and perfected a marvel of lightness and strength.

The second and third gates in the Tanjour cataract were steamed through without trouble, but the fourth was a very nasty place, and two days were spent in preparing for the passage. At the second attempt they got through, and on January 16th found themselves in a wide reach of the Nile, locally known as the Bay of Tanjour. They had now been 15 days in making about 30 miles. The owners of the few native boats which ply on the river at high Nile as far as Abu Fatmeh do not attempt to navigate the river at this season of the year. Taking in cargo and stores which had been brought round the cataracts on camels, they left Tanjour Bay on the 19th, and, passing the Akasha cataract easily, they ran, steaming hard all the time, up the series of rapids, about four miles long, called the Dal cataract, the bottom of the boat continually bumping on the rocks, and reached Upper Dal on the 20th. Five days later they steamed through the Kaibur and then through the Hannek cataracts with few noteworthy incidents. The latter is another succession of rapids about two miles in length, the last gate alone causing them any trouble. Twice they essayed to pass, and the third time they succeeded. At Abu Fatmeh, 30 miles above Kaibur, they re-shipped the cargo and stores which had been brought on camels and by carriers from that place. Dongola—that is, the place marked on the map New Dongola, where the Mudir resides—was reached on January 31st, and on the afternoon of February 3rd they steamed up to Korti, towing a couple of whalers bringing provisions which they had picked up at Dongola. Lord Wolseley and many officers, with some 400 or 500 men, were on the river bank to see them come in, and naval officers who knew the difficulties of the undertaking, expressed their surprise at the successful issue of the venture. After her arrival at Korti, the *Lotus* was once employed to run regularly between Dongola and Korti, taking wounded down and bringing stores up. Although by specification the *Lotus* was only required to carry 25 tons of cargo, she has in fact being taking up loads of 46 tons, comprising grain, ammunition, and provisions. Towing at the same time a barge with 20 tons on board, she has proved her ability to maintain against the current a mean speed of seven to eight miles an hour, a highly satisfactory performance. Two of Mr. Cook's steamers having been wrecked, the *Ghizeh* at Tanjour, and the *Nasif Kheir* at Abu Fatmeh, the *Lotus* is now the only steamer larger than a pinnace at Lord Wolseley's command, and in view of this fact it would seem to be making only necessary provision against contingencies to continue to push on as rapidly as possible the construction of additional steamers of this type which have been ordered. In Messrs. Yarrow's yard at Poplar there are being built five stern-wheel steamers, all larger than the *Lotus*. Of these there are two which have about twice the capacity of that vessel, and three having about 20 per cent. more carrying space. With a patriotic regard for the needs of the service, Messrs. Yarrow have given the War Office authorities facilities for placing additional contracts in the hands of other firms for the construction of boats on the model of theirs, and Messrs. J. Elder & Co. have orders in hand for ten stern-wheel steamers of this type. The two large boats which Messrs. Yarrow are building are so divided by transverse and longitudinal bulkheads as to have 26 water-tight compartments; the three smaller will each have 13 compartments. With a view to economising fuel, all five will be fitted with compound condensing engines. Mr. Broadmeir reports that the railway round the second cataract has been extended rather more than 20 miles beyond Sarras, past Ambigole, and to within about 20 miles of Akasha. Taking the distance by river from Semneh to Korti at 400 miles, it will be seen that the *Lotus*, all stoppages included, made on an average only about 13 miles a day, and this indicates sufficiently the present difficulties of steaming up the Nile.

RUDDERS OF DISABLED STEAMSHIPS.

WHEN the steamship *Picardie*, from New York, was abandoned in the Atlantic in consequence of damage to her rudder, attention was bestowed on the means to be applied on such emergencies in steering ships. The loss of a screw propeller, or the breaking down of the machinery of a steamer, does not create so much danger as the loss of the rudder. Atlantic liners have managed to reach port in safety with broken shafts from the sailing power and the steering gear being intact; but a rudderless ship on the ocean is quite helpless. Within the past few weeks three well-known Liverpool steamers have been disabled in the Atlantic, but fortunately all three of these large steamships were assisted into port. The plan acted upon in such cases is to attach a large steamer astern to act in the manner of a rudder. A small steam-tug will not suffice for this service, as her steering power is not sufficient to keep herself and an exceedingly long vessel straight up to her course. A steamship without a rudder could tow a tug, and if the helm of the latter was broad enough to overcome the yawing and falling off of the former, a course might be maintained sufficiently effective to make slow headway. But a first-class steamship, valued at perhaps £100,000, with a cargo of equal amount, carrying a large number of passengers and a full crew, ought to possess within herself the appliances for making a jury rudder or some arrangement for steering. Water ejected through tubes, one on either side of the vessel, and trained longitudinally, will serve as a substitute for a rudder; or a plunger thrust along tubes may be supplied instead of steam or water. Masters of ships have managed to rig up jury rudders at sea, but when fitted to very long steamers they have been washed away almost as soon as they were completed. When the rudder-head of the steamship *Great Eastern* was broken off, that monster vessel wallowed in the trough of the sea, and had not Mr. Towle, the American engineer, who happened to be a passenger on board, devised a scheme of securing the post, the probability is that she would have foundered, notwithstanding her size and her double engines. Her screw and paddle-wheels with the help of the sails would not bring her up to the wind. Sailing ships of war, and the majority of merchant vessels carried "sweeps," in the shape of immense oars, to rig over the stern, or to run out through the after ports; and the seamen of bygone days knew how to lash them so as to make their blades useful in steering. There are not many sailors now afloat who are accustomed to the handling of "sweeps;" and it is a question whether such oars would be efficacious in ships like those that now cross the Atlantic. The "sweep" was carried through an iron ring in the middle of a chain fastened round the stern with guys to the "sweep" led round under the vessel's counter. By this contrivance the broad blade of the oar was kept in a vertical position. If one "sweep" was carried away by the waves another quickly supplied its place. Instead of seamanship being depended upon nowadays to steer a vessel, mechanical appliances are expected to supply the place of ready and simple contrivances. We consider, therefore, that a substitute should be at hand for steering when an accident

happens to the rudder. Apertures below the load line have never been received with favour. Injection pipes or tubes of any other description may leak or be left open, and this disadvantage attaches to all deep water apertures. But it is possible to fit fins, flappers, or shutters as they have been at times called, to the run of a ship as to be flush with the plates. Messrs. Silver and Moore, on the 19th September, 1861, in a provisional patent for improvements in the construction of ships, provided for what is described as steering floats, worked on either side of the stern or quarter, by a cogged connecting-shaft from side to side of the vessel, actuated by an upright spindle, driving a spur wheel or endless screw, or by a wormed screw. That flap or float was to be let in to the plating of the hull, and moved on pintles. The shaft coming to the deck would be fitted with a stuffing box where it entered the hull, and the gearing at its head could be connected with the wheel, or turned by lever, or operated upon by steam. That invention takes up no space, does not encumber a vessel, and is open free to all who care about having an extra rudder for their ships. Some few years ago Captain Stavers, of the Tyne, patented the same design without knowing of the existence of the application in 1861. At the present moment there is no patent extant to prevent the use of these fins; and as they can be protected at the back by a double casing of a vessel's skin, there need not be the slightest doubt about their safety. The loss by delay on one voyage would pay for fitting several ships. Managers should consider whether anything can be applied to lessen the risks to life and property.—*The Liverpool Journal of Commerce.*

INSTITUTION OF NAVAL ARCHITECTS.

The Address of the President, the Earl of Ravensworth.

UNDER the presidency of the Earl of Ravensworth, the Annual Meeting of this Institution was held in the rooms of the Society of Arts, John-street, Adelphi, on March 25th, 26th, and 27th, when the Annual Address of the President was delivered, and seventeen Papers were read, most of which we propose giving in our columns in this and following numbers of the *Marine Engineer.* There was a very good attendance, among those present being Sir E. J. Reed, M.P.; Sir John Hay, M.P.; Admiral Sir Spencer Robinson, Mr. Denny, Mr. White, Mr. Samuda, &c. In opening the proceedings, the Secretary (Mr. G. Holmes) read the Report, as follows:—

The Council reports with much satisfaction that the financial condition of the Institution continues to be satisfactory. In spite of an increased expenditure, chiefly under the head of "printing," of 123*l.* 14*s.* 9*d.*, the balance in hand at the end of last year was 199*l.* 11*s.* 1*d.* in excess of that of the year preceding, while during the same period the Library Fund was increased by the sum of 106*l.* 18*s.* 8*d.*—a result chiefly due to the large number of new Members and Associates who joined the Institution in the year 1884. The satisfactory amount realised under the head "sales of volume," viz., 170*l.* 15*s.* 7*d.*, shows that the value of the publications of the Institution is steadily growing in the appreciation of the outside public, the larger portion of this item having been obtained from non-members.

In consequence of the heavy increase in the item of printing and engraving, the Council has made new arrangements with regard to the publication of the *Transactions*, which will, it is hoped, result in a very considerable saving. In future the *Transactions* will be published in about two months after the annual meetings, instead of four months, as has latterly been the practice, or seven months as was formerly the case. This comparatively rapid publication will render unnecessary the issue of an edition of the papers, as read at the meetings, to all Members and Associates. This issue constituted, in fact, a first edition of the *Transactions*, and involved the Institution in an expense of about 100*l.*, which will in future be saved.

In order to expedite the production of the *Transactions* new rules have been framed for the correction of reports of discussions, copies of which will be forwarded to each speaker, together with the report of his remarks. Members are earnestly invited to co-operate with the Council in their endeavours to secure an early publication of the *Transactions* by a strict compliance with the new Rules.

The Rules for the admission of Members and Associates have been under the consideration of a Committee of the Council specially appointed. The old rules were found to be somewhat difficult in application, and have never been put fully into operation. The Committee have made sundry suggestions for the alteration of the Rules, which will be submitted for the approval of the General Meeting.

The Report having been adopted, and after formal business was transacted, the President delivered his Address as follows:—

The President's Address.

The Earl of Ravensworth: Gentlemen, I rise to ask your indulgence for a short time while I make a few observations to you, as is usual on these occasions on the part of the President, in the shape of an opening address. I wish to express to you all the very great pleasure that it gives me to meet you again. At the same time, gentlemen, in making a retrospect of events of the past year, I regret that truth does not allow me to find much matter for congratulation. Trade has been almost everywhere more or less bad during the past year, and, if I might borrow a phrase that I saw used the other day, which is a very significant phrase, in one of the leading journals, "Manufacturing industry in the civilized world has been (and I am afraid is still) at a low ebb." And I hardly need tell you, gentlemen, who are practical men, that the depression which trade has suffered almost everywhere has acted with peculiar severity upon the two great industries of shipowner and shipbuilder. Probably these two industries have suffered as much as, or more, than any other, with, perhaps, the one exception of the manufactured iron trade, which, of course, is very closely associated with the shipbuilding trade. And one very curious feature of the depression, out of which we have not by any means emerged as yet, was the rapidity with which it came upon the shipbuilding industry. At the same time it is rather curious to observe, as I think I shall be able to show you, that the depression did not affect quite in an equal degree all our ports. It affected all, but as I said, not in quite an equal degree; because I find that in the Mersey the actual amount of tonnage produced last year was in excess of that produced in 1883. It was 45,000 tons last year, as against 43,000 tons in 1883. The Clyde, also, although I am afraid the depression has largely affected the industry there, presents a very handsome output, considering the circumstances of the year, for the Clyde appears to have produced 299,000 tons last year, as against 417,000 tons in 1883, showing a diminution of no less than 118,000 tons in that great port. The North Eastern Ports present a total something less than the Clyde, namely, 297,000 tons last year; but I grieve to say that the deficiency is represented by no less a figure than 300,000 tons of shipping during the past year in that group of ports which is known as the North Eastern Ports. Gentlemen, vessels, I believe I may say with truth, are building at this moment at 25 per cent. less than they were building at two years ago. No doubt these low prices may attract orders to some extent, and I am happy to hear within the last few days that symptoms of something like greater activity are apparent in the port of the Tyne, with which I am, of course, closely connected. I do not think that the whole diminution in the production of tonnage during the last year, taking the kingdom over, all our ports, can possibly be put at a lesser figure than 500,000 tons. Now, gentlemen, I want you for a moment to consider what that means. I will put the average at £15 per ton, spread over the whole, and I do not think you will say that that is an excessive average, although we know very well that many steamers have been built at prices very far below that—something like £9 a ton; but taking £15 per ton as the average, 500,000 tons diminished production of tonnage means $7\frac{1}{2}$ millions of money withdrawn from the labour markets of our great ports. That, I think, will go a long way to account for the amount of misery and distress and privation which too many of us who are connected with and who live in the neighbourhood of these ports have witnessed during the past winter on the part of the industrial classes (and there are many trades as you know connected with shipbuilding, apart from the shipbuilding trade itself), and which has defied almost the efforts of relief committees to cope with it; but which I must say, from personal observation, they have borne with an amount of courage and patience which does the working classes the utmost credit. But there is a feature in the shipbuilding in the past year to which I wish particularly to call your attention. Steel is still more than ever taking the place of iron. I find that out of the total of 299,000 tons produced upon the Clyde, no less than 128 vessels, with an aggregate of 131,000 tons, were of steel. One eminent firm on the Clyde which we know very well constructed the whole of their vessels with steel. There is another feature in the Clyde trade which I might allude to in

passing: I believe I am correct in saying that the average size of the vessels built upon the Clyde was considerably less last year than it had been in previous years, but one great firm that we know also very well built I think only 6 vessels, but they averaged upwards of 5,000 tons each, and which is a very remarkable output from one establishment. On the Tyne, where our shipbuilders were later in adopting steel in the construction of large steamers, it shows a considerable increase; there were no less than 17 vessels, with an aggregate tonnage of 10,564 tons, built of steel, on the Tyne; and at the other ports the aggregate amount of steel tonnage was 22,340 tons. The total amount of steel tonnage produced in the year appears to have been 164,034 tons. There is another circumstance which will be interesting to many of our members, namely, the increasing use of the triple expansion engine, and the increase of high pressures. I find that 150 lb. pressure is now a common pressure—170 lb. has been reached, and that I need not say is entirely due to the use of steel in the manufacture of ships' boilers. No less than 39 steamers have been built under Lloyds' rules, fitted with triple expansion engines, in the last two years. Forty-three sets are now building, and I believe I am correct when I say that the engineers of the Clyde, the Tyne, the Wear, and the Tees, all predict as a certainty that this is to be the marine engine of the future. I also allude in passing to the economic results of high pressure, and of the use of the three-cylinder engine. It amounts to no less a saving in fuel than from 20 to 25 per cent., which is a strong inducement no doubt to adopt these high pressures and this particular form of engine. Gentlemen, I have alluded to the suddenness with which the crisis came upon the country. I have a few figures here which I will trouble you with to prove that, and to prove also that the severity of the crisis was felt in a very much greater degree during the latter six months of the year, than the former. I will ask your permission to put these figures in, merely to prove the statement I have made, but they do actually prove it; and perhaps you will give me leave to put them in to illustrate that fact. I have said that it is possible, and it is probable we will hope, that the low prices will create some great activity, and induce orders to be given, and it is also probable that the large number of vessels that have been quite recently taken up may have some effect locally—more locally than generally I am afraid—upon the freight market. No less, I believe, than 100 vessels have been taken up and chartered by the Government for war purposes; but I cannot give you better proof of the depressed condition of the freight market than by just reminding you of the prices at which these vessels, many of them the very pick of our great steam companies' fleets, have been taken up—namely, at 17*s.* 6*d.* per ton per month, whereas, in 1882, vessels were chartered by the Government at 28*s.* per ton per month to perform almost precisely the same services. That will give a pretty good illustration, as I have said, of the depression in the freight market; and I think cargo steamers have been taken up also for the conveyance of railway material at the low rate of 10*s.* 6*d.* per ton per month. Now, naturally, I think, it will suggest itself to men's minds how is it, why is it, that manufacturing industry is at a low ebb, and has been for many months past, all over the civilised world? Gentlemen, surely our common sense tells us that it must be owing to the unsettled condition of the civilised world. These diplomatic disputes, and these disputes about boundaries, and these international difficulties that are arising, and—a very extraordinary feature of the present age—that rage that seems to have seized on the nations for colonisation; war, real and prospective, these are all highly detrimental to commerce, because they are destructive of confidence, and confidence is the soul of commerce. With reference to these questions, of course I do not attempt to go into them, I merely express my firm conviction of them; they are, in the main, the cause of the depression of trade all over the world. We have already heard, gentlemen, within a very few days, of war policies being effected, of difficulties arising out of the right of search, and we have also heard that very sinister rumour—I trust that it may not be entirely founded on fact—of the possible transfer of British bottoms to foreign flags. Well, these are all matters that are incident to war, and it appears to me that although a temporary, and I trust it may not be more than temporary, activity may be evinced in some quarters, yet as long as the *fons et origo mali* remains—namely, the fear of war, and the actual existence of war, it is unreasonable to expect anything like a general improvement in the world's trade. All we can do, gentlemen, is to hope for the best, and to be prepared for the worst. There is at least one feature of a satisfactory character in the events of the past year, and that is the increasing interest taken by the nation in its naval affairs. The nation, I hope, has awakened at last from an apathy with regard to its navy, which has been to me a matter of profound astonishment for some years past, and I think I shall be able to show you the effect of that greater attention paid by the public to its naval affairs. In the spring of last year—it was just about this time last year—the Admiralty appear to have entertained some misgivings that our naval strength was not equal to the services that it might be called upon to perform, and also that the rate of construction of our warships was unnecessarily slow in the dockyards, and they accordingly appointed a Committee of Inquiry into two subjects; the first was the mode in which Her Majesty's ships are built by contract, and the second branch of inquiry was the mode in which Her Majesty's ships are repaired and refitted in the dockyards. Well, I am bound to say, having had the honour of being connected with that Committee, that in my humble judgment—with one glaring exception, which naturally occurs to every man's mind, namely, my own self—it was a Committee eminently qualified to perform the duties they had in hand. I say that out of respect to the colleagues with whom I was associated. I do not think you could easily have found, with that one exception, a body of gentlemen (because it was a large Committee) more competent to enter into an exhaustive inquiry upon those two subjects. That Committee reported about the end of the summer—I think in July. Now it has been thought by some persons that the inquiry was not sufficiently extensive. I am not at all sure, gentlemen, that some members of the Committee did not entertain that view themselves, but I should like to point out to you that the Committee was absolutely bound by the terms of its order of reference, and it is not the practice—in fact, it is never done—for either commissions or committees to exceed the terms of their order of reference; but I am very far indeed from saying that I do not think such an inquiry would be necessary; I think it would be highly desirable for the interests of the country that any further inquiry should be of a very much more extended character. I think it would be desirable, but I must point out this, that it would require either a commission or a committee to be very differently composed, inasmuch as any such extended inquiry as might be contemplated would involve such questions probably as the constitution of the Board of Admiralty, the policy of the Board of Admiralty, the whole administration of the dockyards, and the supply of naval ordnance. I think I have said enough to show that the field of the inquiry would be a very large one, and a very difficult one to adopt, whilst it would require, as I have said, a very differently composed commission to undertake such extensive duties as those. The Committee reported, as I said, towards the end of the summer, and I should like, if you will permit me, gentlemen, if I am not occupying your time unreasonably, to point out to you the policy which obviously guided the Committee in its main recommendations. The policy was simply to induce the Admiralty to avail themselves to a much larger extent than they have hitherto done of the resources of our private establishments. But in order, gentlemen, to ensure the co-operation of the able and eminent men who conduct those establishments certain conditions are necessary, and one is that they should have ensured a certain continuity of work, in order that the managers, the heads of those establishments, on their part shall be encouraged to retain in their service a certain body of workmen accustomed to do Admiralty work, and not only accustomed to do Admiralty work but accustomed to Admiralty inspection, because Admiralty work, I need hardly tell you, differs widely from ordinary work, and the inspection being conducted on behalf of the nation is necessarily a very strict inspection. It is also necessary that in order to avoid delays and in order to frame accurate estimates, the designs, and the specifications for carrying out these designs, should be as clear, as definite, and complete as possible. That would enable more accurate estimates to be framed. And it is further necessary, I think, if the working of contracts is to proceed smoothly and expeditiously, which everybody must desire, that the contractors, in conjunction with the Admiralty, should come to a thorough agreement before the work is commenced as to what the work is really to be and how it is to be done. If that were so, many causes of delay would be avoided and the work of the inspectors would, I believe, be confined to two main points, namely—the inspection of the *matériel* and the inspection of the workmanship. The contractors having thus come to that thorough understanding with the Admiralty as to what they wanted to be done, would be left a larger latitude of discretion in carrying out small, and very often insignificant, details in building vessels. The difficulties, gentlemen, that arise now—and they are very great, and cause very great loss of time, and I

need not tell you that loss of time means loss of money—arise suddenly upon matters of detail. Drawings are called for; they are framed by draughtsmen in the contractor's establishment; they are sent up to the Admiralty, and then detained there a considerable time, and returned sometimes with not very extensive, but trifling alterations, and sometimes with no alterations at all. But I need not point out to you that all this is productive of great delay, and if the recommendations of the Committee are to be carried out—and I am hoping to see the Admiralty carry them out—considerable smoothness and expedition in the construction of warships by contract will probably be the result. It is also, I think, necessary, gentlemen, that in controlling work of this kind, and superintending the construction of contract-built vessels, very great care should be taken in selecting the overseers, that their standing and experience should be such as to command the respect of the very able and eminent men with whom they are brought into contact in these private establishments. I am not saying a word against the gentlemen who conduct that work, but with reference to these inspectors it undoubtedly would be a very great advantage to them, and to contractors themselves also, if they had more frequent opportunities of revisiting the dockyards, in order to keep themselves, as it were, abreast of every improvement in the workmanship and carrying out of details, which are now, as you know, extremely complicated; because, undoubtedly, what weighs upon the mind of the Admiralty inspector, when removed far from the Admiralty, is the expectation of the amount of precision that his work will receive at the hands of the dockyard authorities, when the ship is sent round to be refitted. That necessarily weighs upon his mind, but had he more frequent opportunities of revisiting the yards he would know precisely what was going on in those yards, and he would be able to work up to the standard. These are matters dry, but still of very great importance, and I am very glad indeed to think that the Admiralty has shown a sincere desire to carry out the recommendations of the Committee upon these points. I must now allude to the course the Admiralty took in the autumn. The First Lord of the Admiralty towards the close of the Autumn Session—as you know, Parliament was called together for a very special purpose, but I think it was on the 2nd of December—the First Lord of the Admiralty came down to the House and made, what I venture to say is the most important announcement that has been made in my recollection upon naval affairs, and he accompanied his announcement with a very extensive shipbuilding programme. I should like just to quote the words that were used by the First Lord himself on that occasion. In the early part of his speech he said that the announcement he was about to make was the outcome of the state of public feeling that had arisen during the recess in regard to naval questions. Well, the programme, gentlemen, was a very extensive one, the largest that I ever remember (and I have been a long time in Parliament) being presented at one time to the nation. It contained a proposal for the expenditure of £3,100,000, to be spread over five years, in the construction of warships, to consist of four iron-clad vessels; five very powerful steel cruisers—armoured cruisers, provided with belts of steel of no less than ten inches, completely belted; two torpedo rams of the *Polyphemus* type; ten torpedo cruisers—fast-going steel torpedo cruisers; and thirty first-class torpedo boats. With the exception of two of the iron-clad ships, which are to be laid down, one I believe at Portsmouth—the design of which is before Parliament at this moment, because it is exhibited in the House of Commons—and another to be laid down at Pembroke, and with the further exception of the two torpedo rams of the *Polyphemus* type (of which I am sor.y to say we have heard nothing since the programme was presented to the country), with the exception, I say, of those four vessels, it is proposed to build the whole of these vessels by contract. Not only that, but I think the Constructive Department of the Admiralty deserve very great credit for the pains and the rapidity with which they have framed the designs and the specifications, involving as they do great detail, much greater detail than formerly, for the building of these vessels. Tenders have been received for I think six of the *Scout* class, which are the torpedo cruisers, and for a considerable number of the gunboats. For the two armour-clads to be built by contract tenders have been invited; but not, I think, as yet received, and I do not think that the tenders have yet been returned for the steel-belted cruisers. The proposed tonnage to be built by contract has been increased from 4,614 to 11,338 tons; that is the amount of tonnage of ships of war proposed to be constructed by contract in the year which we are just entering upon. Now, gentlemen, there is another event which occurred in the autumn, to which I wish to make just a personal allusion, and that is this: You no doubt have observed, and followed with great interest, the controversy which has arisen upon the matter of the type, the recent type, of our warships, and which has been conducted with very great energy, and has excited no doubt throughout the country very deep interest. Now, do not be alarmed, gentlemen; I am not going to rush into it, because my opinion would be worthless; it would be the height of presumption and folly were I to attempt to pass any opinion upon the subject, but I wish just to make one or two observations in reference to it, because I do entertain a very strong conviction that public opinion will not be satisfied to leave the settlement of this question—the question, namely, of the citadel type of ship with the unarmoured ends *versus* the armour-belted ship—that is the controversy,—I am sure that public opinion will not be satisfied to allow the Admiralty to be the sole judges in their own case in a matter of this kind. It affects not only the six ships that are now building, but it affects five others, that is eleven in all, beginning with the *Inflexible*, the *Ajax*, the *Agamemnon*, the *Colossus*, and the *Edinburgh*, and the six ships of the *Admiral* class. Now it does so happen that the whole of these vessels, with the exception of the *Agamemnon*, are at home at present. This controversy is not a new one, as you know, and as I know also, because I happened to be mixed up with it many years ago in the House of Commons, and took a very deep interest in it; and, therefore, it is that I wish to make a few observations. The controversy arose originally not upon the design of the *Inflexible*, but upon the *Inflexible* when she had advanced a very considerable way towards her completion. Sir Edward Reed, who has been perfectly consistent from the beginning in his objections to this class of ship, is now supported (and this is the point I want to come to) by a very powerful and influential array of naval opinion in his objections. Now I want you to look for a single moment at the position of the naval officer with regard to this question. He says, as English officers have always said, "I am ready to fight your battles; I will go to sea if you choose to send me to sea in a cockle boat; but I do not like this type; my naval experience and my knowledge of gunnery tell me that if these unarmoured ends were reduced to a complete state of destruction by the action of ordinary guns, or the fire of the machine gun which has come into use within quite recent years, the vessel would be in such a position that I could not control her." That is the important point; that is the doubt that exists in the minds of many naval men whose opinions ought to command respect; and I want to know whether some effort ought not to be made to remove those doubts. Now it is very difficult to bring this question to a test, because we cannot expect a Government, an economical Government at any rate, to send one of these vessels to sea and shoot her ends off, in order to see whether she will sink, or swim, or steer after the operation; but surely, gentlemen, this is one of those questions which is essentially one to refer to independent opinion. Why not call in a council of advice upon such a matter as this, affecting no less than eleven of the most powerful ships—represented, at least, to be the most powerful ships—of our navy? There are precedents for this. It occurred in the case of a vessel of Sir Edward Reed's own design long ago—upon the design of the *Devastation* and the *Thunderer*. On that occasion an independent committee of inquiry was formed, and it was called Lord Lauderdale's Committee, and our old and esteemed friend, Dr. Woolley, was a member of that Committee. It occurred again, as I said before, upon the half-completed hull of the *Inflexible*, and I remember well the discussion in Parliament upon it. In that case, Admiral Hope presided over the Committee, and again Dr. Woolley was a member of it. Now, I am merely suggesting this. I am not expressing an opinion one way or the other, but I am convinced that the country will require something in the nature of an independent decision upon this type of vessel. Such an independent tribunal of course would be composed of naval officers commanding the entire confidence of the Service, and, on the other hand, of naval architects, commanding, from their position and experience, the entire confidence of the country at large. But it should be an independent body of gentlemen, unbiased one way or the other, merely to decide from their own mathematical knowledge, and from their own experience and skill and ability, whether or no this is the best type of fighting ship that can be built. That really is the question, because supposing the worst to come to the worst, and these vessels were adjudged not to be suited for the line of battle, they would be most useful in other ways. Nobody complains of the vessels; they would be of the most inestimable value to this country if it were only as guard-ships upon our distant lines of communication in any sea; from their speed (they

run 16 knots an hour), from their prodigious offensive powers, they would be invaluable; nothing could escape them except an *Esmeralda* here and there. Therefore their value as portions of our fleet would be, as I said before, inestimable. The question resolves itself to the narrow point, What is the proper place of these vessels? And I do think that it would be desirable, in order to smooth down any heat that may arise over this controversy, that at least the type should be submitted to something like an independent council of advice, whose opinion would, unquestionably, have very great weight with the country, and with the Admiralty itself. There need be no loss of dignity in this matter. I have shown you that there have been precedents for it, and as to insinuating for a single moment blame to the Constructive Department, I am the last man in the world to do that. I do not imply it in anything that I am saying at this moment. On the contrary, I object in the strongest way to attacks being made upon the Constructive Department; and Sir Edward Reed never said a truer word in his life—and he has said a very great many—than when he said, "I object to the naval architect being lugged in on all occasions into these discussions." The naval architect, after all, is a gentlemen who does what his employer asks him to do, and tells him to do, whether it is a private employer or a public employer. He says, "Tell me what you want; I will tell you what I can do; I will tell you what I cannot do. But tell me what you want, and I will design the ship for you, upon my experience, upon my mathematical knowledge, upon which my reputation very largely depends." That is the position of the naval architect, and if the ship happens to be not all that is expected of her you have no right to blame the naval architect; you must blame the man who ordered the ship, and who furnished the design, at least so it appears to me. Now I want to prove, from the mouth of a member of the Board of Admiralty himself, upon the question I have put, "Is this the best type of ship for the line of battle?" that he also shares in my opinion. The Secretary of the Admiralty said only the other day, on the 15th of March, in a very able speech which he addressed in moving the naval estimates, "A great service like ours demands perfection, and is sensitively jealous of the slightest superiority." Well, nobody has said more than that, and the question is, Is this the most perfect type of ship? and that I say is a question upon which the country has a right to be satisfied. Now, gentlemen, we must be charitable, and we must remember that the Admiralty themselves have laboured under very great difficulties of late years in ship construction. There have been delays, unaccountable delays, but, at the same time, they have had to contend with two great difficulties; first of all, the introduction of compound armour, and secondly, the substitution of the breech-loading gun for the muzzle-loading gun; and this question of the guns is really the question that lies at the bottom of the delays and the difficulties, of which the outside public are complaining, and with some reason, that occur in the completion of our ships of war. No less an authority than the Director of Naval Construction said in my presence this last year, "If we only knew exactly what the gun was to be, and its charge, at the time of designing the ship, we could build any ironclad in three years." Now we all know that ironclads have taken six years to build, and I myself saw last year a magnificent ship apparently finished lying in the basin at Chatham; she was the *Conqueror*. We asked when the ship was going to be commissioned. "Oh! she is waiting for the breech screws of her big guns." And I am told, gentlemen, that she is waiting there still for the breech screws of her big guns—the ship complete in every respect, her guns on board, and she is waiting for her screws! Now that cannot be right, and consequently I am extremely rejoiced, and I am sure you will be rejoiced, to hear that quite recently, within the last few days, a Commission has been appointed by the Admiralty to inquire into this question of the big guns; because it is really one of the most important questions in regard to ship construction that can by possibility be considered. The 110-ton gun I understand takes fifteen months to make, about half the time that would be required to build an ironclad by contract. And in view of two or three most important considerations, an exhaustive inquiry, both into the supply of our great guns, and into the material that composes them, is, I think, absolutely necessary and fair, by the country; because they want to be enlightened upon certain points, in view of the inordinate length of these guns, their unwieldy length; in view of their immense weight, which necessitates their being placed high in the ship; in view of their prodigious explosive powers (and it is contemplated to put two of these guns in the same turret); in view, last of all, but certainly not least, of their prodigious cost; and in view, likewise, of the risk and difficulty attending the striking of a moving object at a great distance—at their full distance—which would inevitably weigh upon the minds of officers. I hope the Committee will ascertain the broad fact, whether these monster guns are necessary for sea fighting. I think it demands the very best consideration, and I trust that it will be given to it. There are other matters connected with the supply of the material, the steel ingots, which is a most important question, and I am very happy to hear in reference to that matter, that at least two most eminent firms at Sheffield are at this moment engaged in laying down the plant, the costly and extensive plant, for the purpose of making the steel ingots necessary for our gun manufacture. But, gentlemen—this is almost the last remark I have got to make—the time has come, in my humble opinion, when the country has a right to expect the Admiralty to be responsible for the supply of its own guns for its own ships, altogether independent of any other Public Department. Until that is done my belief is that these disappointments in the fulfilling of the programme of the year will occur, and we shall have to face the difficulties that have arisen for many years past, not so much in the building as in the completion of our ships of war. Now, gentlemen, I am extremely grateful to you for the kindness with which you have listened to my undue attacks upon your patience; I feel that I owe you many apologies. I thank you most cordially for the kindness with which you have listened to me.

MOST SUITABLE PROPELLER FOR SHALLOW DRAUGHT.*

By J. I. Thornycroft, Esq., Member of Council, I.N.A.

TWO years ago I had the honour of reading before this Institution a Paper on the efficiency of Guide-blade Propellers, as determined by experiments on small models.

The results obtained by some boats fitted with this kind of propeller, since built by my firm, induce me to bring the subject again before you, so as to compare the improved propeller with the paddle-wheel, its only rival in shallow water, and I wish to express my conviction that this modification of the screw will supersede the paddle-wheel in shallow water. In the same manner as the paddle-wheel has already been displaced from deep water by the simple screw, so this modification of the screw will supersede the paddle in shallow water, and from the same causes.

The paddle-wheel has been able to withstand the screw in shallow water, first, because it required less draught, and secondly, because wood or even iron vessels, of great relative length to their depth, are ill adapted to sustain the weight and vibration of a propeller at the extreme end of the hull.

The use of steel for the structure of shallow vessels has removed this last difficulty, while the first is taken away by employing the guide-blade propeller with a special form of hull, to further reduce the necessary immersion of the propeller, so the paddle-wheel has now to compete with an instrument of about the same efficiency as the simple screw, which can be successfully used in shallow water, its only fault being very limited power to propel astern, but this deficiency is balanced by an increased manœuvring power in going ahead.

If, then, I may assume that the screw, and its near relation the screw with contracting boss and guides, are equal, it becomes simply a question of Paddle *v.* Screw, and this I will now take as being more among the known quantities.

It is difficult to determine the relative efficiency of the paddle and screw with exactness. Mr. John Elder considered that a feathering paddle with thin metal floats, was about as efficient as a screw-propeller. Mr. Scott Russell, I think, was inclined to favour the paddle-wheel.

Mr. W. H. White, in his book on Naval Architecture, considers the screw more efficient even in smooth water than the paddle, but the *Victoria and Albert* seems to give a higher co-efficient than any screw steamer of about the same size. I think, however, the evidence so evenly balanced that for smooth water the two kinds of propeller may be considered as equal without fear of any considerable error being made, if we confine our consideration to the simple question of economy of indicated power utilized in propelling. But this is not sufficient; for weight, space and cost have all to be considered.

* *Read at the Twenty-sixth Session of the Institution of Naval Architects, 26th March, 1885.*

With regard to weight of propelling machinery, I would wish to call my hearers' attention to a Table in a Paper I prepared for the Institution of Civil Engineers in 1881, on Torpedo Boats and Light Yachts.

The Table referred to gives the weight of propelling machinery per I.H.P. for a number of vessels, paddle and screw, and is adapted to show that, although the paddle engines were constructed with great economy of material for their bulk, their weight was necessarily much more than their screw rivals, and this owing to their limited power to make many revolutions in a given time. To make the comparison complete it must be stated that the power of rapid turning is enjoyed by the guide-blade propeller in the same degree as in the screw, and the extra material in the hull and propeller case, when adapted to shallow draught, is not sufficient to seriously affect the comparison.

The paddle-wheel is necessarily heavy in itself, and cannot be adapted to high-speed engines without the use of gearing, so it entails heavy engines. Its own size and weight may be explained by the small portion of the wheel acting on the propelling stream at any instant; all parts, however, which are employed necessarily have each to be sufficiently strong to resist the full force of the engines.

The continuous action of all the parts of a properly immersed screw requires no explanation, and the stress on the various parts is subject to little more than the amount of variation communicated by the shaft in the effort exerted by the engines.

From what has already been said of the paddle, it will be evident that its great bulk as a propeller is also accompanied by a great increase in the bulk of the engines necessary to drive it, when compared with screw engines of equal power, and increased cost, follows as a natural consequence, without considering the restricted carrying power of the vessel for useful purposes.

It is therefore established that the guide-blade propeller is the most suitable propeller known for shallow water, giving more available space and weight-carrying capacity in a given vessel at a reduced total cost.

To illustrate the manner in which the special form of hull used assists in producing the result described, I beg to refer to a tug boat built for the Nile, and fitted with twin screws. In this boat the propellers of 36 in. diameter projected above the water line 6½ in., but water was carried over them by the hull, and was sustained by the greater external pressure of the air, the draught of the vessel being 29½ in., measured to the lowest part of the propellers. Careful trials were made with this boat on the Thames, December 1875, and the experiments indicated a larger proportion of work in the tow-rope than might seem praticable. When towing at 10·7 knots, the power indicated by the engines was 93· ; of this it is estimated that 37·4 were expended in propelling the boat, and from the measured stress on the tow-rope, at the speed given, it is found that 24 effective H.P. were actually expended in towing.

From this it will be seen that the efficiency of the screws in towing must be ·54 if the effective power in the shafts be taken at ·8 of the indicated work, or the combined efficiency of the engine and propellers is equal to ·43; other experiments at a higher speed gave as high a result as ·55, but are perhaps open to doubt.

Trials were also made on the Nile with the same boat in February, 1876, when a towing trial was made with a dahabeah of 48 tons displacement, and a speed through the water of nearly 9½ knots was obtained, with great regularity of working.

Had this launch been fitted with the improved propellers, the draught might have been reduced to 18 in.

The speed obtained by a shallow vessel, also built for the Nile, and fitted with one propeller only, is so satisfactory that I would ask time to give the principal dimensions of that vessel.

	ft.	in.
Length, extreme	56	8
Beam	7	6
Draught	1	3

Speed, 18·45 miles; load carried, 23½ cwt.

And I will conclude by stating that an equal speed is not practicable within these dimensions using any other propeller than the one adopted.

A special torpedo course for naval officers on half-pay of the rank of commander and upwards, will commence on board the *Vernon*, at Portsmouth, on Monday, April 13th, and conclude about June 5th.

SOME FURTHER EXPERIENCE WITH TRIPLE COMPOUND ENGINES.*

By A. E. Seaton, Esq., Memb. I.N.A.

My attention was first called to the modern triple compound engine by the published reports of the trial trip of the yacht *Isa*, and in it I plainly discerned the germs of a successful new type of engine; but it was not until I had seen the engines of the screw steamer *Aberdeen* erected in the workshops of Messrs. Robert Napier & Sons that I became convinced that it was the engine of the immediate future. It is, however, due to the farsightedness and enterprise of Mr. C. H. Wilson, M.P., that I was enabled to try the merits of the new system and compare it with the old. Mr. Wilson had already viewed the triple compound engine with more than ordinary interest, and it required little persuasion on my part to allow the Company to which I have the honour to belong to construct a triple expansion engine in lieu of the ordinary compound for one of four sister ships which it then had in hand for Messrs. Thomas Wilson, Sons & Company, the latter only stipulating that it was to be of the same power as the engine already contracted for. As I was quite convinced that economy was due to the system rather than to the higher pressure, it was decided not to increase the boiler pressure more than was necessary to suit the triple system. The other three ships already alluded to were being fitted with engines having cylinders 25 in. and 50 in. diameter by 45 in. stroke, and supplied with steam of 90 lbs. pressure from a double-ended boiler 13 ft. 9 in. diameter by 15 ft. long, having a total heating surface of 2,310 ft., so that these engines had every qualification for being economical so far as general proportions went, the stroke being an abnormally long one and the boiler of ample size. Experience has since shown that these engines are economical in coal and the wear and tear exceptionally small.

The new engines for the fourth boat were made with considerably shorter stroke, and the cylinders proportioned so as to give equal power; they are 21 in., 32 in., and 56 in. diameter by 36 in. stroke, the high-pressure cylinder being supported on columns immediately over the medium cylinder, and in other respects these engines were made as near as possible like the other ones above named. Steam at 110 lbs. pressure is supplied from a double-ended boiler 12 ft. 9 in. diameter, and 15 ft. long, having a total heating surface of 2,270 square feet, and identical in design with the boiler supplied for the other engines. The propellers were made exactly alike in all respects and the ships being likewise precisely alike, a comparison of the performances of the one fitted with the triple engines could be made with as little grounds for differences of opinion as is possible.

One of the ships fitted with the ordinary compound engines was named the *Korno*; that with the triple compound engines the *Draco*. Their dimensions are as follows:—Length between perpendiculars, 270 ft.; breadth, 34 ft.; depth of hold, 18 ft. 3 in.; and of 1,700 tons gross register. They are ordinary cargo boats built of steel, having a raised quarter-deck and long bridge amidships, but nothing about them otherwise requires comment.

After making a voyage or two to the Baltic, and finding that everything was working satisfactorily, the *Korno* was loaded with 2,400 tons dead weight, and sailed in January, 1883, for Buenos Ayres; the *Draco* was loaded with 2,425 tons dead weight, and sailed March, 1883, for Bombay, the distance in both cases being about 6,400 miles. It was thought advisable, for purposes of comparison, that the ships should steam at as near as possible the same speed, and to attain this object we considered the safest plan was to instruct the engineers as to the average amount of coal they were to burn per day, and experience with these ships on their Baltic voyages had fixed this at 12 tons in the case of the *Korno* and 10 tons in the case of the *Draco*. During the voyage each ship seems to have had fair average weather, and equal care was taken in getting the best results possible. The average speed of the *Draco* was, however, 8·625 knots, or 207 miles per day, the engines making on the average 57·5 revolutions per minute, while the *Korno* did only 8·1 knots, or 194 miles per day, the engines making 55·5 revolutions. The coal used was ordinary South Yorkshire, just as it comes from the pits for bunker purposes. The I.H.P. in each case would average about 600.

The total coal consumed was 326 tons in the *Draco* and 405 tons in the *Korno*, or a saving of 19·5 per cent. over the ordinary compounds, with an increase of speed of 6·5 per cent.

* *Read at the Twenty-sixth Session of the Institution of Naval Architects.*

In December, 1883, one of the others, the *Grodno*, sailed for Bombay, and attained an average speed of 8·5 knots, or 204 miles per day, the engines making 57 revolutions, with a coal consumption of 12·8 tons per day, or 469 tons on the voyage. The *Draco's* consumption is therefore 30·5 per cent. less than that of the *Grodno* on the round voyage and 20·3 per cent. per day.

The success of the triple compound engine was in these instances more than had been anticipated, and induced Mr. Wilson to go a step further.

The s.s. *Yeddo* had been refitted with boilers made for a working pressure of 90 lbs. per square inch, but owing to the size of the shafting the working pressure was limited to 70 lbs.; the average consumption of coal under these circumstances on two voyages was 17 tons per day. These boilers had a margin of safety beyond what was required by the rules when made, and as the Board of Trade Rules had been modified in the meanwhile, it was found that they could with safety be worked at 100 lbs. per square inch. A third cylinder was now fitted on the top of the original low-pressure, and the safety valves loaded to the 100 lbs., and the ship was despatched to Cronstadt. After making two voyages under similar circumstances to the two previous ones, the average consumption was 13·5 tons per day only. In this case it was the same ship, same boilers, same engines, same propeller, and same men, the only difference being the addition of a third cylinder and the increase of pressure.

So far all the trials had been made with two crank engines, so it was now decided to construct another set of engines for 150 lb. pressure, having a crank to each cylinder. These engines had cylinders 20½ in., 33 in., and 58 in. diameter by 36 in. stroke, and were fitted into the screw steamer *Rosario*, whose dimensions are 275 ft. 3 in. between perpendiculars, 34 ft. 3 in. beam, and 19 ft. 2 in. depth of hold, 1,862 tons gross, and the dead-weight capacity 2,550 tons. In March last year she was loaded with 2,530 tons dead weight, and did the voyage to Bombay at an average speed of 8·6 knots on a consumption of 10·5 tons per day of South Yorkshire coal, and burnt on the voyage 347 tons. This result is superior to that of the *Draco*, when the size of the ship is taken into account, but is not so much so as might have been anticipated from the increase of pressure and the rate of expansion, which was 14·4 in the *Rosario* and 12 in the *Draco*.

Another set of engines was made from the patterns of those of the *Draco*, but with the high-pressure cylinder 20 in. diameter, steam at 150 lbs. pressure being supplied from two single-ended boilers, having a total heating surface of 2,200 square feet. They are fitted in the s.s. *Finland*, a cargo boat 270 ft. long, 35 ft. beam, by 18 ft. depth of hold, and 1,954 tons gross register. In January she was loaded with 2,500 tons dead weight, and sailed for Rangoon. The average speed attained was 8·42 knots per hour, or 202 miles per day, on a consumption of 10·3 tons of Welsh coal per day, the rate of expansion being 12.

It should be mentioned that all these ships named are fitted and steered with steam steering-gear, so that in comparing these results and those published of the engines made by an eminent engineer in the north of England, an allowance should be made, as in that ship there was no steam steering-gear.

I have chosen to make all these comparisons by reference to the ships' logs and to give results such as a shipowner looks for rather than those which engineers prefer to use in forming a judgment on the merits of different engines. I do this for two reasons: first, because the commercial success of the triple compound engines depends on the saving it can effect in a long voyage; and second, because I had no reliable indicator diagrams from which the consumption per I.H.P. could be calculated with any degree of accuracy. On trial trips with the steamers already named, the consumption of ordinary South Yorkshire coal was 1·6 lb. per I.H.P., and the consumption of water per I.H.P., calculated from the high-pressure indicator diagrams, was 14·1 in the *Draco*, 13·2 in the *Rosario*, and 13·16 with the *Finland*, or taking the medium-pressure diagrams, it was 12·2, 13·0, and 11·95 respectively.

Twelve months ago we constructed for Messrs. Thos. Wilson, Sons & Co. two sets of triple expansion engines of 600 I.H.P., one having two cranks and the other three cranks, the engines, boilers, and propellers being otherwise exactly alike and fitted into sister ships. The water consumed in the three-crank engine is 12·93 lb., against 13·0 in the two-crank, but the former drives its ship nearly ½ knot per hour faster than the latter does, and when both ships are driven at the same speed the consumption of coal in the three-crank ship is considerably less than in the other.

We have now entirely given up the construction of two-crank triple expansion engines, because of the impossibility of equally dividing the work between the cranks; for, although the engine when running appeared to be perfectly balanced, the wear of the brasses of the crank having the two cylinders was always considerably more than that of the other. Placing the H.P. cylinder over the L.P. cylinder seemed to give the most satisfactory results, but even these were far inferior to those once obtained with the three cranks.

We have lately constructed some very small three-crank engines from which exceedingly good results were obtained; the cylinders are only 11½ in., 17 in., and 30 in., by 18 in. stroke, which developed 218 I.H.P. with a consumption of 12·8 lb. of water per I.H.P., and this, together with some other observations, leads me to believe that the best economical results will be obtained by running triple expansion engines at a much higher number of revolutions than is usual and with a rate of expansion not less than 12 for a steam pressure not less than 140 lb. (155 lb. absolute).

The largest engines we have made of this type so far are those of s.s. *Martello*, which have cylinders 31 in., 50 in., and 82 in. diameter by 57 in. stroke, and indicate at sea 2,400 H.P. when running at 60 revolutions with steam of 150 lb. pressure; the consumption of Yorkshire coal is 37 tons per day average throughout a New York voyage.

Had Welsh coal been used in every case, the results would have been very much better, for in addition to the superior evaporative power of Welsh coal, it is slow burning, and much more easily controlled, especially on the comparatively short grates of these modern boilers, the quick-burning Yorkshire coal causing the safety valves to frequently blow off when working near the load-pressure unless great care is taken by the firemen.

I trust these few particulars may be of interest to the Institution, and especially to those members of it who are particularly interested in the commercial success of our mercantile navy. I have purposely avoided engineering details and technicalities of any kind, giving only such information as will tend to give British shipowners faith in that form of engine which will undoubtedly help them to successfully tide over bad times, and keep the bulk of the carrying trade of the world in their hands.

ON THE EFFICIENCY OF MARINE BOILERS.*

By J. T. Milton, Esq., Memb. I.N.A.

THE struggle for economy in the production of power for the propulsion of vessels, which has shown itself during the last few years by the gradual increase of steam pressures from 60 to 90 lbs. per square inch, has lately been marked by the extensive adoption in new vessels of the tri-compound engine using steam with a pressure of from 140 to 180 lbs. per square inch. These pressures are not likely to be increased for some time at least, unless some type of boiler is introduced which will not necessitate the present size of casing for containing the steam and water, nor the present method of internal firing, as with the obtaining pressures the thicknesses of plate for these portions have reached the maximum capable of being worked on the one hand and of being used for the transmission of heat on the other. The almost universal failures of new types of boilers in the past seem to show that the supersession of the present type of boiler is not at all probable; while, even if a new type of boiler does come into general use admitting of higher steam pressures being obtained, it is extremely improbable, in my opinion, whether steam of the higher pressures would be usable, owing to its high temperature. At a pressure of 180 lbs. per square inch the temperature is 379°, while, if we go to, say 300 lbs., the temperature would be over 420°.

From these considerations it appears to me that if any further great step in economy is to be obtained it must be looked for in the *making* of the steam rather than in the using of it, that is to say, we must turn our thoughts to the boiler, rather than to the engine, which has up to the present nearly monopolised the attention of engineers.

Undoubtedly there is here a promising field for improvement. It is well known that, theoretically, the heat which may be developed by the combustion of 1 lb. of good coal is sufficient to evaporate about 14 lbs. of water from 100° to 212°; but actually

* *Read at the Twenty-sixth Session of the Institution of Naval Architects.*

few marine boilers when working at full power really evaporate more than eight or nine lbs. of water per lb. of coal burned. Suppose that the evaporation of nine lbs. of water is obtained, there is still between nine and the theoretically 14 a large margin upon which to work.

In ordinary boilers working with chimney draught we have at the outset a very large amount of heat necessarily expended in producing the draught; but even with chimney draught much might be done in the design of the heating surfaces and funnels to abstract more of the heat from the products of combustion, and still to leave them of sufficiently high temperature to produce the draught required; but when we consider that experience with many ships has shown that forced draught can be applied with almost equal facility to the chimney draught, it is evident that we are no longer compelled to waste heat up the funnel otherwise than by our inability to abstract it from the products of combustion. It is, I believe, by the application of forced draught to marine boilers that the next step in economy will be obtained.

The conditions to be aimed at in the design of steam generators are principally three—

(1) The most perfect combustion of the fuel must be effected so as to obtain the maximum amount of heat from it.

(2) The arrangement and extent of the heating surfaces must be such as to be capable of extracting the greatest possible portion of this heat from the products of combustion.

(3) The construction of the boiler must be such as to ensure its endurance under the conditions to which it will be subjected.

Now as regards the first of these, the theoretical requirements are well known. An amount of air must be supplied to provide sufficient oxygen to completely oxydise the carbon and hydrogen of the fuel, and must be brought into intimate contact with the fuel at a high temperature. In order to supply this oxygen, however, a greater or less additional supply of air must be admitted to dilute the carbonic acid formed, and so allow a fresh supply of oxygen to have access to the fuel.

It appears that the sharper the draught the less additional air of dilution, as it is called, is required, and it is evident that the less air of dilution required, the higher will be the temperature of the products of combustion, because the same amount of heat will be contained in a smaller quantity of matter.

This question is gone into in detail in Articles 227–233 of "Rankine's Manual of the Steam Engine," so that it will only be necessary for me to here quote the following figures from a table given in Article 233:—

Temperature.	Supply of air in lbs. per lb. of fuel.		
	12	18	24
	Volume of gases per lb. of fuel in cubic feet.		
4,640°	1,551	—	—
3,275°	1,136	1,704	—
2,500°	906	1,359	1,812
1,472°	588	882	1,176
752°	369	553	738
392°	259	389	519

If the temperature of the atmosphere is 60°, and the fuel is burned by just so much air as contains the necessary amount of oxygen for combustion, viz., 12 lbs. of air per lb. of fuel, the resulting temperature of the products of combustion will be 4,640°. If 18 lbs. of air are used the temperature will be 3,275°, and if 24 lbs. of air the temperature will be 2,500°.

The table given shows the volumes of the resulting products of combustion at these, and also at lower temperatures; and it is seen that with the smaller quantities of air, not only are the temperatures much higher, but although the products are more expanded on account of their higher temperatures, yet their resulting volumes are also less, while, of course, at equal temperatures their less volumes are still more apparent.

This reduction of volume has a most important bearing upon the transmission of heat from the products of combustion to the water, even if the temperatures are the same, for in a given boiler the less the volume of the gases which has to pass through it in a given time the less will be their velocity; or, in other words, the individual particles of the gases will be in contact with the heating surfaces for a time longer in direct proportion to the reduction of the volume, and therefore, other things being equal, more heat will be transmitted. And since the reduction of volume is also accompanied by a much higher initial temperature, from both considerations, intensity of draught, if accompanied by reduction of air supply, must be conducive to increased efficiency. The influence of the higher temperature will be most marked at the first part of the heating surface, and the reduction of volume at the last part, or tail end of the run of gases.

The correctness of this deduction has been proved over and over again in cargo steamers, with the performances of which I am acquainted, in which, when first built, large grates have been fitted. The grate areas have been gradually reduced in some cases by as much as 20 per cent., maintaining the same evaporation of water, since the engines have been worked at the same speed. The greater rate of combustion resulting from the decreased grate has resulted in higher furnace temperatures and greater efficiency of boiler since the consumption has been reduced to a marked extent.

With regard to the second point, viz., the proportion of heating surface to the quantity of fuel burned, I think that the recent practice of some of our engineers has been retrograde so far as economy is concerned, the proportion of surfaces having been reduced considerably. There is a manifest temptation to do this, as undoubtedly the last portions of heating surface to which the gases are exposed must be, surface for surface, less efficient than the first portions, owing to the temperature of the gases being lower, so that a reduction of tube surfaces does not make nearly so great a reduction in steaming capacity as it does in weight and cost. And where a large power on trial trip only is worked for, irrespective of economy of fuel, or where the total weight of boilers is more important than coal consumption, this might be considered to be a good practice; but there can be no doubt that for long ocean voyages, where the coal to be carried forms an important part of the carrying capacity of the vessel, a larger extent of heating surfaces would often mean less total weight of boilers and coal to be carried, besides being a continuous economy in cost of coal and labour of stoking.

As an instance, I may quote the case of some steamers of over 4,500 tons gross register, and regularly advertised as being 4,000 H.P., built in 1882, in which the total heating surfaces of the boilers bear to the grate area the proportion of 25·8 to 1, while in a similar vessel built by the same firm last year, the proportion is only 21·4 to 1. In very many vessels doing good work the proportion is from 30 to 35 to 1.

That the extent of the heating surfaces may be increased with advantage considerably above that obtaining in the steamers quoted, I will adduce the cases of some other vessels in which the boilers were constructed with the proportion 35 to 1, and in which, in addition, feed-water heaters have been fitted in the base of the funnels, bringing up the surfaces to the proportion of 36·7 to 1, without even then reducing the temperature of the gases to an extent incompatible with good draught. This heater has given results, even with the large amount of heating surfaces in the boilers, sufficiently encouraging to warrant their being fitted into several other vessels.

In a later vessel by the same firm the proportion of heating surfaces in the boilers proper to the grate area is 30 to 1, and the feed heaters in this case have been made rather larger, raising the proportion to 32·1 to 1.

In this case I am informed that when running at full power the feed water becomes raised in temperature more than 40°, while even when the vessel is running at a lower speed with less consumption of coal, and therefore with a less funnel temperature, the feed-water is raised in temperature 25°.

If these figures are correct, the saving of heat is quite tangible, and it is evident that the boilers in which the proportions are 21, or even 26, to 1, cannot be expected to be even fairly economical.

I may here remark that Mr. Howden, in his system of forced draught, places an amount of heating surface in the uptake, in order to absorb some of the heat which would otherwise pass up the funnel, but he prefers to heat the air supply in this manner, instead of heating the feed water. Although with the same area exposed, the feed-heater must be heavier, both on account of the greater thickness of the tubes on account of strength, and also by the weight of the contained water, yet area for area the feed-heater must be much more efficient, not only on account of the specific heat of water being more than four times that of air, but also on account of the much greater weight of the water. Assuming the abstractive power of water and air to vary as the products of their specific gravities and specific heats, water would be about 3,500 times as efficient as air.

(*To be concluded in our next*)

JOICEY'S PATENT "CESTUS" MULTITUBULAR BOILER.

THE boiler we have pleasure in herewith illustrating is an additional form of the "Cestus" boiler we described in our issue for last November (page 208), and consists of a modification by which the boiler previously described is converted into a multitubular one.

stays for the same, and so do away with the otherwise necessary use of nutted stud-stays.

As in the vertical "Cestus" the annular space at the junction of the conical fire box and combustion chamber is large enough to admit a man between the shell and the furnace for examination or repairing.

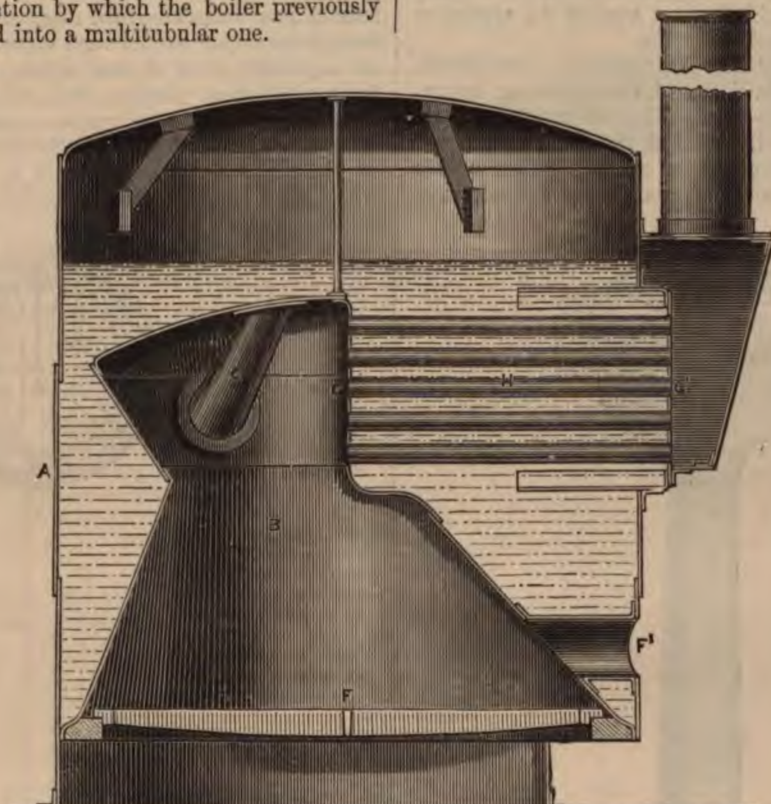


FIG. 1.

As will be readily seen, the boiler now illustrated possesses nearly all the advantages of the vertical type as regards complete accessibility to all the parts both back and front, and also as regards the efficiency of its circulation, and consequent freedom from fouling and priming.

Referring now to the illustrations, it will be seen that the fire box B is conical, the fire bars F resting on a suitable ring support at the base of the cone, the fire box being attached to the shell A in the ordinary manner, and provided with the usual fire hole F^1. The combustion chamber, as regards the greater part of its circumferential length, partakes of the form of an inverted cone, and is joined on to the apex of the conical fire box, but, as is shown on the plan, it has also a considerable portion of its surface flattened to form the tube plate G, a corresponding tube plate G^1 being attached to the shell, which is strengthened at this part by two table stays, one above and one below the tubes, formed of flanged plates, and rivetted on to the shell as shown.

The immense heating surface afforded by this form of fire box and combustion chamber is still further increased by employing, in addition to the horizontal tubes H, diagonal circulating tubes C, extending from the sides to the roof of the combustion chamber; these not only serve to increase the heating surface, but act as most efficient

The Licensee of the Patent, Mr. H. Fletcher, of Gateshead-on-Tyne, is represented in London by Messrs. Stevenson and Davies, of 11, Queen Victoria Street, E.C.

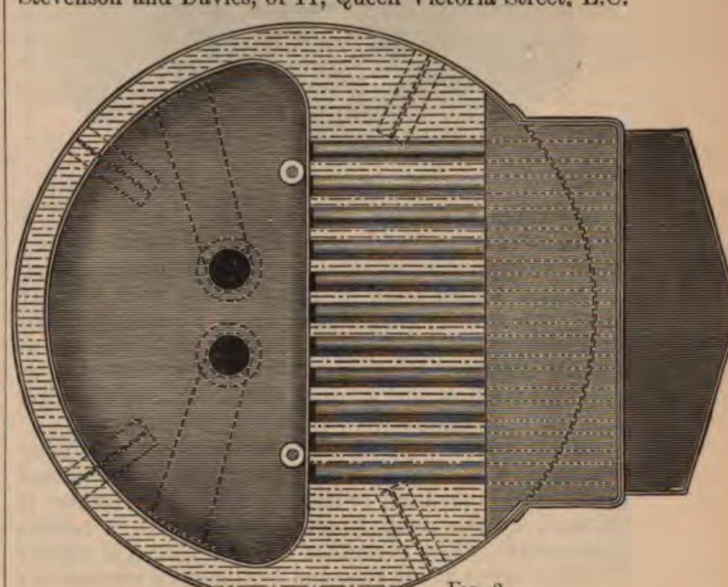


FIG. 2.

FARQUHARSON AND LANE'S PATENT ELECTRICAL SHIP'S TELEGRAPHS.

THROUGH the courtesy of the sole manufacturers, Messrs. Latimer Clark, Muirhead & Co., Limited, of Regency Street, Westminster, S.W., we have recently been enabled to thoroughly inspect a set of the apparatus we now have pleasure in illustrating.

The figures represent the transmitting instrument, placed upon, say, the bridge, and the receiving instrument, fixed in the engine-room. The two instruments are connected by a single wire, and as the electrical current is not employed as the prime or moving power of the parts, but only as the means of controlling the release of a stored-up power in the receiving instrument, a minimum of current and consequently very small battery power suffices, the battery being only in action during the actual transmission of signals. We need scarcely point out to our readers the great advantage, when bulkheads have to be passed through, of being able to connect the two instruments with a thin wire in place of the usual shafting and gearing employed in conjunction with the hand telegraphs.

As will be seen from the illustrations, the transmitting instrument consists of a pointer placed over an illuminated dial, having the usual orders upon it. The pointer is actuated by the small handle (provided with a ratchet arrangement, which permits of its being turned in the one direction only,) at the side, and has upon its vertical axis a contact maker, which, as it rotates, makes and breaks a contact at each particular order, and thus transmits a distant signal corresponding with each particular order passed over by the pointer.

The connection of the contact maker with the gearing of the handle is so arranged that when the latter is turned the pointer and contact maker do not move until the handle has made a certain number of revolutions, when they jump slowly to the next order. This is effected by an ingenious piece of mechanism, consisting of a large horizontal wheel gearing with the handle, and having mounted upon it a small vacuum pump barrel, the piston of which is pivoted to an arm projecting from the axis of the pointer. On this axis is also mounted a star wheel, with which a spring-impelled detent piece engages.

The action is as follows: On turning the handle the horizontal wheel is caused to rotate, and the pump barrel moving with it a vacuum is created behind the piston. The handle, after having been turned a sufficient number of times, withdraws, by means of a small cam with which it is also geared, the detent piece from the star wheel and so frees the axis of the pointer, which is immediately caused to partly rotate by the vacuum acting on the now freed piston, the stroke of which is so proportioned as to carry the pointer over a space equal to one order on the dial. Simultaneously with the movement of the pointer the contact maker transmits the current to the receiving instrument, the pointer of which is impelled by clockwork; here the work to be done by

the current is of the simplest and lightest description, for its sole use is to excite a small electro-magnet, which serves by means of a dead-heat escapement to liberate the needle step by step—or, more correctly speaking, order by order—as the impulses reach it, a light prolongation of the magnet's armature striking upon a gong at every impulse. A small red disc appears at a circular aperture in the dial when the clock-spring has nearly run out; but as once winding this suffices for over 600 signals there is little fear of its running down during the voyage.

THE "DISINCRUSTANT MARSEILLAIS."

THIS well known and now extensively used boiler composition is produced exclusively from purely vegetable matter, and being perfectly free from all acid or soda, it cannot possibly prove injurious to either iron, brass, copper, or other metal. Its action is such as to prevent any saline or other matters attaching themselves to the interior surfaces of the boiler, as by its use they are deprived of their cohesive power, and they are thus, on account of their greater specific gravity, compelled to precipitate themselves to the bottom of the boiler, where there is the least amount of disturbance from the ebullition of the water. Here they are found to collect in the form of a soft muddy sediment, which can be readily blown off at convenient intervals. The disincrustant gradually but most effectually removes old incrustation.

The sole manufacturers, the Disincrustant Marseillais Company, of 36, Knowsley Street, Cheetham, Manchester, are doing an extensive business with many of the large steamship companies, and we hear on very good authority that the composition is doing its work satisfactorily.

BROWN AND PAINE'S PATENT BOAT ROWLOCK.

WE illustrate herewith a very ingenious, yet neat and simple, device for permitting a rowlock to be unshipped while yet keeping it secured to the boat when

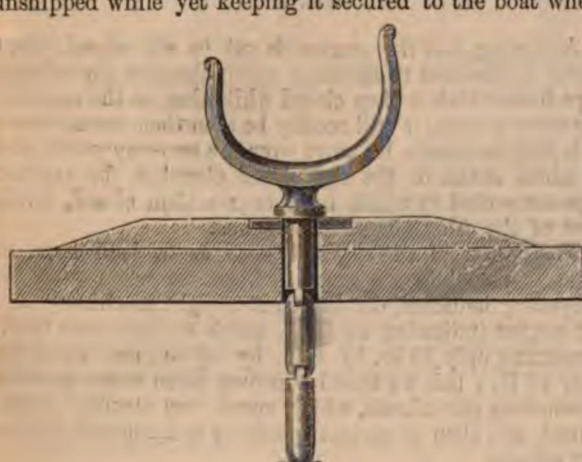


Fig. 1.

not in use, and in such a manner that it cannot be lost or abstracted. The simplicity of its action will be seen at once from the illustrations, of which fig. 1 shows the rowlock shipped ready for use, fig. 2 shows the same unshipped and turned down out of the way, while fig. 3 shows a rowlock fitted with a solid stop piece. In shipping the rowlock, it is simply necessary to lift the horns, when the articulated leg iron falls into position by its own weight, the stop piece or split pin preventing the rowlock being lifted entirely out of its place at any time. In the case of the

Fig. 2.

Fig. 3.

solid stop piece it is necessary that the bottom joint should be rivetted up after the rowlock has been put through the gunwale of the boat. This pattern is used where there is any chance of the rowlock being stolen. Messrs. William Reid & Co., of 5, New London Street, E.C., are the sole licensees and manufacturers, and are supplying the rowlock at very low figures.

Messrs. Fraser & Fraser, he steam - boilermakers of Bromley-by-Bow, London, E., obtained the order for the supply of nine immense wrought-iron tanks to occupy the entire hold of the s.s. *Woodcock*, which is to be stationed at Suakin, as a water-ship for the use of the troops. The order was received by Messrs. Fraser & Fraser, on Saturday, the 28th February, the iron, which had to be specially made for the work in Staffordshire, was delivered to them on the following Saturday, the 7th March; and in one week, viz., on Saturday, the 14th March, Messrs. Fraser and Fraser had the satisfaction of delivering and fixing the whole of the tanks in the hold of the vessel. This is considered one of the most expeditious feats performed in the arrangements for sending out the Relief Expedition to the Soudan.

Orders for five troop boats for the Nile.—Messrs. Thornycroft & Co., Chiswick, have received orders from the Government to build five troop boats for the Nile. The boats, which are to be 140 ft. long, will have 21 ft. beam, and are only to draw about 2 ft. of water. They are to be fitted with twin compound engines, and when completed will be packed up and forwarded by barge for re-shipment to their destination.

OTWAY'S HIGH-SPEED ENGINE.

THE inventor's main object in designing this engine has been to gain a maximum amount of efficiency with a minimum number of working parts, while at the same time keeping the dimensions and weight of the engine at their lowest—advantages which cannot be over-estimated in a high-speed engine, or, in fact, in any other form of quick-running machinery.

The engine is shown in the accompanying illustrations,

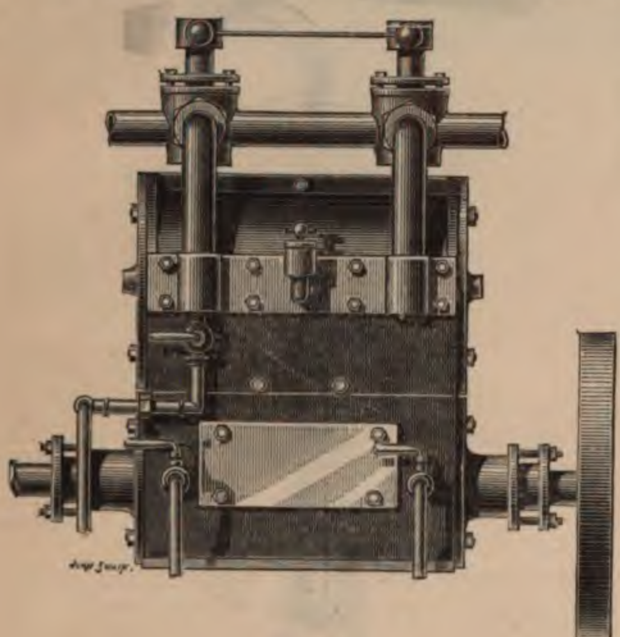


FIG. 1.

of which fig. 1 is an elevation, fig. 2 a plan, and fig. 3 a transverse section partly in elevation.

From the latter figure it will be seen that the cylinders are of the oscillating type, and that the peculiarity of their construction consists in boring each of them out of

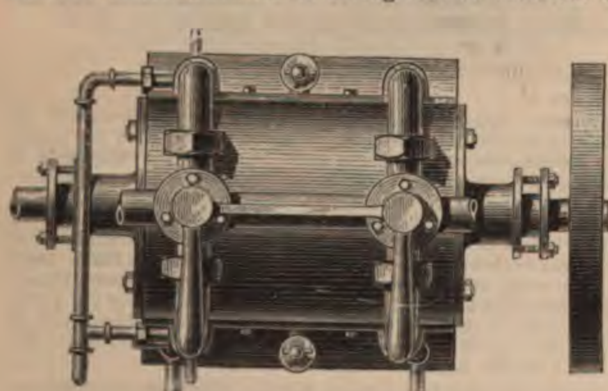


FIG. 2.

a cylindrical metallic block, in which the four steam passages, two on either side, leading respectively to the top and bottom of the cylinder, are also formed.

The cylinders—three in number—in the engine we are now noticing oscillate within an outer cylindrical casing provided at each end with covers, in the centre of which the two outermost trunnions take their bearing, the inner or middle cylinder having formed on its outer surface suitable recesses for the reception of the inner trunnions of the outer cylinders.

From this it will be seen that the whole weight and effect of work done in the cylinders is carried by the outer cylindrical casing, and that the trunnions merely serve to centre the cylinders, any number of which may thus be placed side by side.

The outer cylindrical casing is also provided on each side with horizontal steam chambers, extending nearly its whole length, the admission of steam to either one or other of these chambers being controlled by the two-way valve surmounting the engine. Each chamber is also provided with an outlet communicating through a stop-valve with the exhaust pipe.

FIG. 3.

Assuming that the engine is set to run ahead, when steam is admitted to the hand steam chamber the exhaust pipe from which is then closed while that on the opposite chamber is open, it will readily be seen that to run astern it is only necessary to move over the two-way valve, and so admit steam to the right-hand chamber, the exhaust pipe connected to which is of course then closed, while that of the other chamber is opened.

The design of the engine is such as to lend itself to extreme portability, a great desideratum when used for propelling launches, driving electric light machinery, &c. An engine indicating $2\frac{1}{4}$ H.P., which we have seen tried, measuring only 10 in. by 8 in. by $5\frac{1}{2}$ in., and weighing only 40 lb.; this we timed ourselves when running at 10 revolutions per minute, which speed was steadily maintained, and then at various speeds up to 2,200 revolutions per minute.

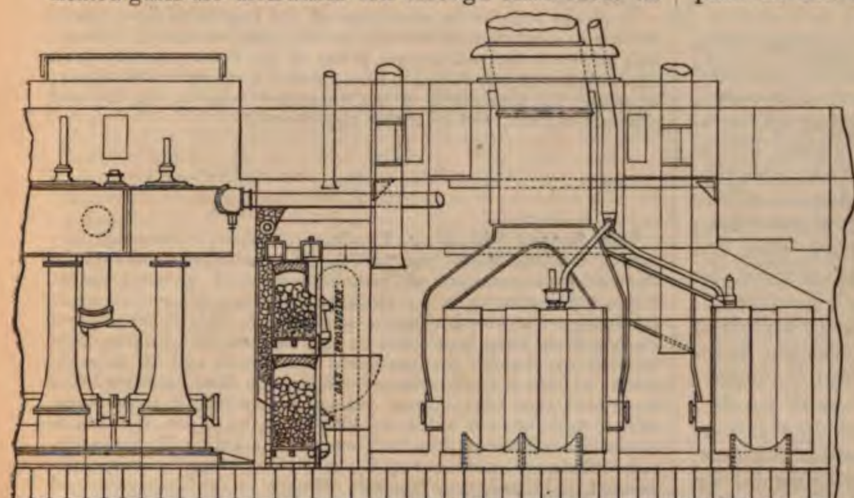
The inventor and manufacturer, Mr. H. Otway, of 137, South Lambeth Road, is constructing engines of a larger size, on the triple expansion principle, and has promised to place full tests of the same in our hands for publication.

THE APPLICATION OF GASEOUS FUEL FOR FIRING MARINE BOILERS.*

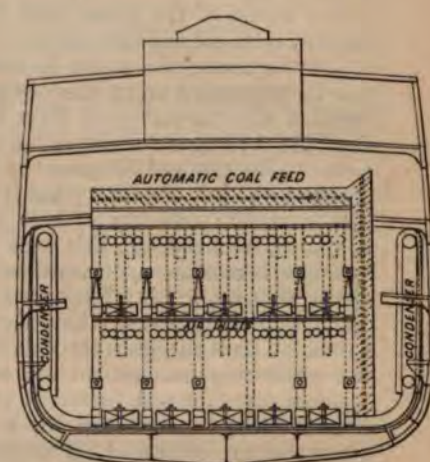
ALTHOUGH great improvements have been effected within the last few years in marine engineering, yet the generation of steam is still carried on in the same wasteful and imperfect manner ; indeed, the waste of fuel in the generation of steam required for some of our large ocean steamers reaches an enormous figure. The ordinary type of marine boilers, in which the combustion of the fuel is arranged in a large flue, and the heated gases are afterwards led through small tubes on their way to the smoke stack—as far as the distribution of heating surface in relation to the absorption of the heat is considered, is based on correct principles; the fatal defect, however, is the system of the combustion of the fuel.

When solid carbonaceous fuel is burned in the ordinary manner in the furnace of a marine boiler, the volatile hydro-carbons evolved come in contact with the plates of the furnace, which, assuming the pressure of steam to be 60 lbs. per square inch, will not, therefore, have a temperature higher than 290 deg. Fah. The result of the contact of the combustible gases is the reduction of the temperature of the nascent gaseous carbon to a fixed and solid condition as smoke, and it therefore passes through the furnace and tubes of the boiler unoxidised, or unconsumed, and representing so many heat units absolutely lost, besides producing thick volumes of smoke, to the great detriment of the cleanliness of the vessel, and causing considerable discomfort to the passengers.

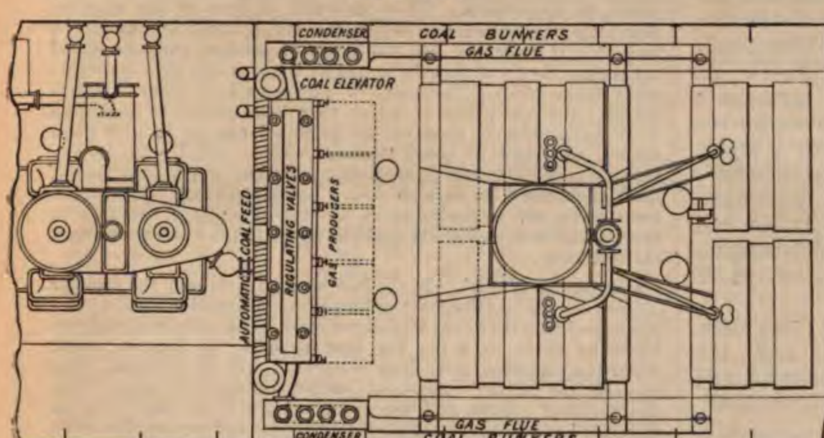
Many methods have been tried to remedy the acknowledged imperfection by ill-conceived arrangements applied to the boiler furnace, but they have generally proved futile. The one remedy is, therefore, the generation of the gas in separate furnaces, or gas producers, and the utilisation of forced steam blast pressure to ensure a rapid evolution of the combustible gases. Mr. Thwaite arranges his gas producers in compact batteries, and in two or more storeys, directly over each other. He has found this side to side arrangement, from actual experience, to be the best, as not only is the wasteful radiating surface reduced, but there is a more equable temperature and production of the combustible gases and an enormous saving of space, which is of primary importance.



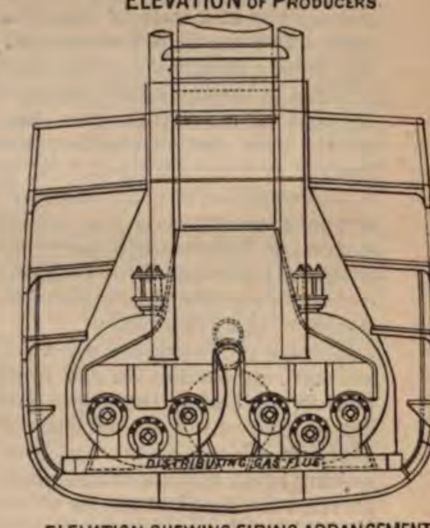
SECTION



ELEVATION OF PRODUCERS



PLAN



ELEVATION SHEWING FIRING ARRANGEMENT

*Arrangement Patented by B. H. THWAITE, C.E., F.C.S., &c., of 37, Victoria Street, Liverpool.

The chemical principle of the production of the gas is, according to Mr. Thwaite, F.C.S., as follows :—

The mass of solid fuel, always kept at a considerable depth, is, owing to the blast of air and steam, kept in a state of active combustion at the grate, evolving carbondioxide (CO_2). This gas in ascending through the fuel, which is in a partial state of combustion, takes up another atom of carbon from the partially consumed fuel, and becomes carbonmonoxide (CO), a combustible gas which becomes considerably enriched by the addition of the rich hydro-carbon gases evolved from the fuel immediately the latter becomes heated ; the gases are then led away by means of refractory lined flues to the boiler furnaces.

The action of the steam used for the air blast is as follows :—On coming into contact with the fuel in a state of incandescence, the steam is split up, or dissociated, into its component parts, the oxygen entering into combination with the carbon to form carbondioxide, liberating the hydrogen, which adds considerable calorific power to the combustible gases by the reduction of the nitrogen which it displaces ; but it should be understood that a certain quantity of heat is absorbed when the steam is dissociated, but this heat is regained when the hydrogen is reoxidised, or consumed in the boiler furnace.

Mr. Thwaite, in his scheme, uses a duplicate system of condensing the gases. When such condensation is required, he leads the gases through water-lined chambers ; this condensing arrangement acts as a feed water-purifier, or saline depositor and heater. After leaving the condensers the gases are then led to the boiler furnaces, where they are consumed on another plan—patented by Mr. Thwaite. By this latter patent the combustible gases, when in a state of luminous ignition, are not permitted to come into contact with any part of the flue, but merely radiate their heat until they are completely oxidised to carbondioxide and watery vapour (H_2O). At the end of the furnace flue, the inventor arranges a solidly built nest of checker brickwork, which, by the passage of the gases through it, is brought to a highly heated condition of incandescence ; this heat accumulator arrangement prevents the passage of any unoxidised carbon or hydro-carbon gases through the boiler, and completely prevents the deposition of the bad conductor carbon on the tube or tube plates, and produces an equable action of heat transmission.

The gas producers are water-jacketted on three sides, and have air cavities on the front, or fourth side ; the floor for clinkering the upper producers is hinged, and can be lowered in position when clinkering is required, which is seldom, as the fire bars are kept continually moving by an automatic and simple arrangement, which prevents the conglomeration of clinkers. The whole of the fuel is fed into the producers automatically.

By the use of Mr. Thwaite's marine producers, the commonest slack coal, having any combustible constituent at all, can be used, and, by means of a simple arrangement, the gases can be so enriched as to serve for culinary purposes, and by the use of the albo-carbon lamps also for illuminating purposes ; and may bring the use of gas engines for marine purposes within a measurable distance. We welcome this step in the history of marine engineering, and commend it to the attention of all marine engineers and shipowners who recognise the immense value of the application of correct scientific principles in producing more effective and economical results.

STEAM TRAWLING IN BRAZIL.

WE understand that a concession has been granted by the Provincial Government of Para, Brazil, to Messrs. Castel and Pontet for the purpose of supplying this important city with fish.

The concession, which is for a considerable term of years, involves the use of steam trawling vessels, with necessary refrigerating apparatus of the most modern and improved quality.

Captain Pontet, of the above-named firm, is now in England arranging matters, and we are informed that he has placed the order for his steamers with Messrs. Cochran & Co., of Birkenhead.

The steamers are the first boats built for this purpose on the Mersey, and we believe the first vessels of the kind built of steel in England.

It speaks well for the enterprise of the Provincial Government of Para to encourage an industry so important as that of fishing ; and no doubt the enlightened policy of the President, who is so unwearied in endeavouring to increase and cheapen the fish supply, especially for the benefit of the working classes in the city and province of Para, will be highly appreciated.

The Steam Shipping Trade.—(*C. Moller's Steamship Circular.* London, March 2nd, 1885.)—The prolonged dulness of the steamship business has at last been relieved to some extent through the chartering by Government of a number of steamers for transport service during the past month. About 60 ships of various sizes have been fixed on this side, at rates varying from 17*s.* 6*d.* to 11*s.* 6*d.* per ton gross per month, and 20 ships in India, at rather higher figures. Although these rates are lower than have ever been known, yet owners are glad to accept them rather than let the ships lie idle in port. Upon freights in general this business has had, as yet, no noticeable influence, and although we are now rapidly advancing towards spring, the demand for ships is very languid. Owing to the losses sustained last year by shareholders, a great deal of tonnage has been offering for sale, and at prices so low that many purchases have taken place on speculation. There are still buyers in the market, especially for steamers in which the management shares can be bought. If these get into the hands of prudent and economical managers, they will be able to pay as soon as any little improvement takes place. The builders' prospects have somewhat improved; the low prices at which they have offered to undertake work have induced some of the principal owners to give them orders, and most of these steamers will be fitted with triple-expansion engines, which, according to recent trials, have proved most economical as regards fuel. Besides this, the Government have given out contracts for a number of ships of the smaller type, which will materially assist to alleviate the distress amongst the workmen.

Composite Yacht.—In the last week of February the steamer *Afghan* shipped at Glasgow the framework and machinery of a composite yacht for the Prime Minister of Siam. The vessel will measure 80 ft. by 13 ft. by 8 ft., the framing being of Siemens' steel, while the planking and other woodwork will be of teak. The engines are of the compound surface-condensing type, with direct-acting pumps, and the cylinders are 10 in. and 20 in. in diameter respectively, with stroke of 14 in., and are supplied with steam of 100 lb. working pressure from a large steel boiler. Messrs. Ross & Duncan, Glasgow, are the contractors.

The Central Graving Dock and Engineering Company, Limited, Swansea, has supplied eight large water tanks by order of the Government, fitted complete, on board the *Solway King* (s), of Whitehaven, which boat proceeds to Suakin ; and after gathering all the water she can obtain from the condensing vessels in the harbour, she will pump the whole into a tank placed at a considerable elevation. The water will be conveyed from this tank by means of pipes along the line of railway to Berber, for the use of the troops and workmen in laying the line. The tanks hold about 260 tons of water. Two large Tangye pumps have been fitted on the deck of the *Solway King*, each capable of lifting 30 tons an hour.

International Inventions Exhibition.—His Royal Highness the Prince of Wales, President of the International Inventions Exhibition, has fixed Monday, the 4th of May, for the opening of the Exhibition.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of* The Marine Engineer *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—Ed. M. E.]

LAUNCHES—English.

Eastwood.—On February 21st, Messrs. Earle's Shipbuilding and Engineering Company, Limited, Hull, launched from their yard a fine iron screw steamer, 256 ft. by 34 ft. by 17 ft., built to the order of Robt. Jameson, Esq., of the same town, and to the highest class in the Liverpool Registry. The ship has a raised quarter-deck bridge over engines and boilers, and topgallant forecastle forward, and will be rigged as a schooner with two pole-masts of iron. Water ballast is provided in after hold and engine space. Powerful steam winches are fitted for working the cargo, steam being supplied to the same from a large multitubular donkey-boiler in the stoke-hole. The captain's cabin and two spare state-rooms are fitted under the bridge amidships, and the engineers and officers are berthed at the side of the engine-room. She will also be provided with steam steering gear amidships and screw gear aft. She is to be propelled by triple-compound double-action three-crank engines, capable of indicating 700 H.P., steam for which will be supplied from a large single-ended boiler made of steel, in accordance with the Board of Trade rules and regulations, for a working pressure of 142 lbs. per square inch, this being the tenth set of triple compounds made by Earle's Company.

Astoria.—On February 28th Messrs. Robert Thompson & Sons launched from their Southwick shipbuilding yard, Sunderland, the *Astoria*, an iron sailing barque, built to the order of Messrs. Peter Iredale & Son, Liverpool, and of the following dimensions: Length, 240 ft.; breadth, 38 ft.; and 21 ft. 9 in. depth of hold. She has been constructed under Lloyds' special survey for the highest class and under the personal superintendence of Captain Penny. The vessel has raised quarter-deck and monkey forecastle, large iron deck-house amidships, with accommodation for crew, the apprentices being placed in forepart of quarter-deck; cabin aft for captain and officers, spare berths, and all the latest improvements have been introduced on board, and the fittings throughout are of the best style.

Alacrity.—On February 28th there was launched from the shipbuilding-yard of Messrs. Palmer & Co., Jarrow, her Majesty's twin-screw despatch vessel *Alacrity*, which had been built to the order of the Admiralty. The vessel was built entirely of steel, manufactured by the Consett Company, the Steel Company of Scotland, and the Bolton Company. The principal dimensions of the vessel are:—Length, 250 ft.; breadth, 32 ft. 6 in.; depth, 18 ft. 6 in. The cylinders are 26 and 50 in. respectively in diameter, with a stroke of 34, and an I.H.P. of 2,000; and under a forced draught the engines, which are horizontal, will indicate 3,000 H.P. The vessel is intended to travel at the high rate of 17 knots per hour. The engines and boilers are below the water-line, and are protected by an inclined steel deck, thus dividing the under and above portions of the ship into two distinct watertight compartments. In addition to this the casings of the engines and stokehole are surrounded by coffer-dams to prevent the water finding its way in, in the event of damage being done by shot. The forward end of the ship is appropriated for the accommodation of the officers, crew, magazine, store-room, &c.; while the after part and lower deck are fitted with saloons, cabins, &c. Ample means are provided for pumping in case of fire, and ventilation arrangements.

Transition.—On March 2nd there was launched from the yard of her builders, Messrs. Raylton, Dixon & Co., a steamer named the *Transition*, which has been built to the order of Messrs. J. M. Lennard & Sons, of Middlesborough. The vessel is built to carry 2,350 tons deadweight, and is of the following dimensions: Length, 267 ft. over all; breadth, 36 ft.; depth moulded, 19 ft. 6 in.; she has water ballast throughout, and her general arrangements are in accordance with the best class of quarter-deck cargo steamers. Her name indicates a transition from the use of iron plates to that of steel, made entirely in the Cleveland district, the angles and beams being from the works of Messrs. Dorman, Long and Co., and plates made by Messrs. Bolckow, Vaughan & Co., at their steel plate mill, at Eston. This is the first ship built entirely of local steel; but, already the makers have contracted for many thousands of tons, and have their order books full for months to come. Another important improvement, also commemorated by the name, is the transition from the ordinary two cylinder compound engines to the triple expansion engines, having a steam pressure of 160 lbs. per square inch, which is utilised in three cylinders, working direct on to three cranks, and thus giving great steadiness of motion, as well as very great economy in the coal consumption, which has been proved by experience to be not less than 25 to 30 per cent. On leaving the ways, the vessel was christened by Mrs. Lennard, of Leven House, Hutton Rudby, in the presence of a large number of owners and friends. In the course of speeches which were subsequently made, Messrs. J. M. Lennard & Sons were congratulated on their enterprise in venturing with this somewhat experimental steamer at a time like the present, when shipping industry is so much depressed; but when it is necessary in order to earn any dividend at all the vessel should contain in herself the very latest improvements in regard to carrying capacity and economy of consumption. With regard to the steel used in the construction of this vessel, Mr. R. Davidson, Lloyds' chief surveyor, West Hartlepool, responding for Lloyds' surveyors, stated that in his very extensive experience of steel used in shipbuilding, he had never tested a better material than was being made at the above-named works, and employed so largely now in shipbuilding on the north-east coast. A hope was expressed that *Transition* also implied passage from the depressed state of the shipbuilding industry to more prosperous times, the yard of her builders being now comparatively busy, compared with the state of affairs when this vessel was commenced to the order of Messrs. J. M. Lennard & Sons, a few months ago.

Express.—On March 5th, at Kingsbridge, a paddle steamer, designed to succeed the South Hams Trader, which for the past five or six years has plied between Kingsbridge and Plymouth for passenger and general traffic, was launched by Messrs. Date & Sons. The new boat is named the *Express*, and was so christened by Miss Beer, daughter of Mr. W. R. Beer, the managing owner. Her dimensions are:—Length, 102 ft.; beam, 19 ft.; depth, 9 ft. She has engines which are diagonal and surface condensing, and of 60 N.H.P., supplied by Messrs. Willoughby Bros., of Plymouth. In addition to trading as a passenger and general cargo steamer between Plymouth and Kingsbridge, it is intended to use the *Express* as a tug, for which work she is admirably adapted, being fitted with patent feathering floats and every other modern improvement. The *Express* is to be immediately towed to Plymouth to be fitted.

Flying Fox.—On March 14th there was launched from the building yard of Mr. J. T. Eltringham, Stone Quay, South Shields, an iron paddle tug, the dimensions being 122 ft. by 20 ft. 3 in. by 11 ft. The vessel is of the most modern and approved type, and, in addition to the usual requirements for towing purposes, is specially designed for salvage work, having a large hold for the conveyance of steam pumps and salvage machinery to wrecked vessels. She will be fitted with a side lever surface-condensing engine of 98 N.H.P., steam for which is supplied by two steel multitubular boilers, working at 45 lbs. pressure. The paddle-wheels are on the feathering principle. The vessel, which on leaving the ways was named the *Flying Fox* by Miss Alice Rennoldson, has been built to the order of Messrs. J. P. Rennoldson and Sons, South Shields, who will supply the machinery, and is intended for the towing trade on the Clyde, her owners being the Clyde Shipping Company, of Glasgow and Greenock. The *Flying Fox* is the twenty-eighth vessel supplied to this company by Messrs. Rennoldson.

Virgo and Libra.—On March 14th, Messrs. Earle's Shipbuilding & Engineering Company, Limited, launched from their yard, at Hull, two iron steam trawlers, 105 ft. long by 20 ft. beam, by 10 ft. 9 in. depth of hold, built to the order of the Grimsby and North Sea Steam Trawling Company, Limited, of Grimsby. These boats are of somewhat similar design and similarly arranged to the *Zodiac*, the plans of which took prizes at the Exhibition of the Worshipful Company of Shipwrights, at the Fishmongers' Hall, London, in 1882, and at the International Fisheries Exhibition, 1883, but, in many respects, are a decided improvement on that ship. They will be fitted with all the modern requirements for trawl fishing, such as Earle's special

steam trawling winch, windlass, &c. The vessels will be fitted, by the builders, with their triple-compound, direct-acting, surface-condensing three-crank engines, capable of indicating 200 H.P., having cylinders 11½ in., 17 in., and 30 in. diameter, by 18 in. stroke, which will be supplied with steam from a steel boiler, made for a working pressure of 140 lbs. per square inch. The vessels were christened *Virgo* and *Libra* respectively as they left the ways.

Floating Dock.—On March 17th the large floating pontoon dock which has been in course of erection at the River Tyne Dry Dock, Engineering and Boilermaking Company's Works, at Low Walker, during the last ten months, was successfully launched. The new dock is 260 ft. in length, her beams are 63 ft., her height 29 ft., and the depth of her tanks 10 ft. She can be sunk in half-an-hour, and raised up again with a ship upon it in the space of three hours. This will be effected by the combined power of two of Tangye's centrifrugal engines, which are placed at one end of the dock. She is provided with 18-inch pumps, she has two boilers each 10 ft. in diameter and 9 ft. 6 in. long, and she has 2,800 tons of water ballast, exclusive of side tank. There are altogether twenty-five tanks, the centre one, which extends the full length of the dock, serving as a drain for the rest. The engines have been supplied by Messrs. Tangye Brothers, and the boilers by Messrs. Wigham Richardson & Co. The rest of the work has been done by the company, and about 1,200 tons of iron have been used in its construction. It is surmounted by a platform running the whole length of the dock for the use of the workmen.

Sitona.—On March 18th there was launched by Messrs. Wigham Richardson & Co., from the Neptune Yard, Low Walker, a steamer for the Avena Steam Navigation Company of Sweden, to trade between Uddevalla and London, under the management of Messrs. Thorburn, of Uddevalla, and under the command of Captain Hellberg. The christening ceremony was performed by Miss Mina Marshall, of Tynemouth. The name given is *Sitona* (equivalent to Ceres), derived from the Greek word Sitos, grain. The machinery, of the builders' own manufacture, will be placed on board at once, and about the middle of April the *Sitona* will make her first voyage to Sweden. The whole of the work has been carried out under the superintendence of Mr. Thomas Todd, engineer and naval architect, of London.

Opal.—On March 18th the *Opal* steamer was launched from Messrs. Waite & Son's yard, West Cowes, and her boilers were at once placed in her. She was then hauled up for completion. She has been built for Major Brideson, and is a steel screw yacht, 44 tons Thames measurement, 68 ft. between perpendiculars, and 22 ft. 2 in. beam.

Limena.—On March 18th there was launched by Messrs. W. Gray & Co., from their yard, an iron sailing barque of the following dimensions:—190 ft. by 32 ft. by 18 ft. 6 in., and about 835 tons gross, built to the order of Messrs. Brodersen, Vaughan & Co., of Liverpool, to class 100 A1 in Lloyds and A1* (20 years) class in red in Liverpool Registry. The vessel, which is handsomely modelled, has a raised quarter-deck aft, with accommodation for captain and officers, and a large house amidships, in which the crew will be comfortably berthed. The forepart is protected by a topgallant forecastle, with Clark, Chapman & Co.'s combination capstan windlass. A fire-engine pump is fitted with pipes leading throughout the vessel, and all through she is well found in everything necessary for sailing her and working cargo. She has been superintended during construction by Captain W. F. Splatt, and is intended for the West Coast trade. The christening ceremony was gracefully performed by Mrs. F. H. Vaughan, the vessel being named *Limena*.

Itumba.—There has lately been launched from the yard of the Barrow Shipbuilding Company an iron screw steamer, built to the order of Messrs. Hatton & Cookson, of Liverpool, for the West Coast African trade. Her dimensions are—130 ft. in length, by 25 ft. breadth, by 9 ft. depth of hold, with a gross register tonnage of 250. She has been built under special survey to the requirements of the Liverpool underwriters, to enable her to obtain the highest class in their registry. The vessel has a full poop aft, a flying bridge amidships, extending from side to side, and topgallant forecastle for sailors and firemen, and a wooden awning both fore and aft. She is fitted with four watertight bulkheads, and iron bulkheads at the ends of the poop and forecastle, and the whole of her appointments are of a most substantial character. She will be provided with one of Messrs. Reid & Sons' patent windlasses for working the anchors, and two of Messrs. Clarke, Chapman & Co.'s steam winches for working the cargo, and will be rigged as a fore and aft schooner with two iron pole masts. She will be propelled by a pair of compound inverted direct-acting, surface-condensing engines of 400 I.H.P., having cylinders 20 and 40 in. in diameter, by 24 in. stroke, and a working pressure of 100 lbs. per square inch. As the vessel left the ways she was christened the *Itumba* by Mrs. H. Darley, wife of the Government overseer resident in Barrow. The ship has been built under the superintendence of Mr. George Hepburn, consulting engineer, Liverpool.

LAUNCHES—Scotch.

Northward.—On February 18th Messrs. H. M'Intyre & Co. launched from their shipbuilding yard at Merksworths, near Paisley, an iron screw steam trawler of 220 tons, built to the order of the Great Northern Steamship Fishing Company, of Hull. The steamer will be fitted with compound surface-condensing engines of the most modern type by Messrs. Muir & Houston, Glasgow.

Firth of Stronsa.—On February 26th Mr. William Thompson, Whiteinch, launched from his yard an iron barque of 1,250 tons, to the order of Messrs. James Spencer & Co., of the Firth Line, Glasgow. The vessel was named the *Firth of Stronsa* by Miss Macleod. The ship has been built with all the most recent improvements to insure safety at sea, and has special fittings for the colonial trade, under which her flag is intended to trade. She has been constructed under special survey to the highest class of Lloyds, and her length is 228 ft.; breadth, 36 ft. 6 in.; and depth, 21 ft.

Britannia.—On February 28th a new screw steamer, built to the order of Messrs. Jas. Currie & Co., and intended for the passage between Leith and Newcastle, was launched from the yard of Messrs. S. & H. Morton & Co., Victoria Docks, Leith. The dimensions of the vessel are:—210 ft. long, 27 ft. beam, and 14 ft. 6 in. depth of hold, with a gross tonnage of 850 tons. She will be supplied by the builders with compound surface-condensing engines of 120 N.H.P. The hull of the vessel has been constructed throughout of steel, and to the highest class in Lloyds, is fitted with every modern improvement, and has accommodation for a number of cabin and steerage passengers. As the vessel left the ways she was named the *Britannia*, by Miss Currie, Trinity, Edinburgh.

Lalpoora.—On February 28th Messrs. Wm. Denny & Bros., launched from the Leven Shipyard, the *Lalpoora*, a steel screw steamship, for the British India Steam Navigation Company, Limited. The *La'poora* is a vessel of about 3,310 tons gross register, and of the following builder's dimensions:—Length between perpendiculars, 340 ft.; breadth (moulded), 42 ft.; depth (moulded), 29 ft. She is classed at Lloyds 100 A1, three-decked, and is constructed on the continuous cellular bottom principle. She is fitted with saloon and state-room accommodation for thirty-two first class and sixteen second class passengers. The vessel will be fitted by Messrs. Denny & Co. with direct acting surface-condensing engines of about 2,000 I.H.P., designed on the triple expansion principle, having four cylinders. The ceremony of naming the *Lalpoora* was performed by Miss Clark, daughter of Sheriff Clark.

Rosalind.—On February 28th Messrs. A. Hall & Co., Aberdeen, launched a fine steel barque of 380 tons gross register; she was named the *Rosalind*, and measures 140 ft. by 27½ ft. by 13 ft.; she has been built to the order of Messrs. John Sutcliff & Sons, Grimsby, and is intended for the West India trade.

Fifeshire.—On March 4th Messrs. Russell & Co. launched from their shipbuilding yard at Port Glasgow an iron sailing ship of 1,300 tons register, built to the order of Messrs. Thomas Law & Co., Glasgow, for their Shire Line. The vessel has been constructed under special survey for the highest class at Lloyds, and is fitted with all the latest and most approved appliances. On leaving the way she was named the *Fifeshire* by Mrs. Greig, wife of Captain Greig, her commander, and late of the *Hannah Landles*.

Isla.—On March 4th Messrs. Blackwood & Gordon launched a screw steamer for the conveyance of heavy material at bridge work. Dimensions:—Length, 78 ft.; breadth of beam, 22 ft.; depth of hold 8 ft. 6 in. The vessel has been built to the order of Mr. David Gordon, Port Glasgow, for Messrs. Wm. Arrol & Co., Glasgow, and under the superintendence of Mr. Andrew M'Gechan, marine surveyor, Glasgow, Mr. Gordon himself constructing the machinery. She was named the *Isla*, and is the

first of four vessels the builders have in hand for the Forth and Tay Bridge contractors. The *Isla* is to be engaged for the carrying of material at the construction of the Tay Bridge.

Bandaneira.—On March 5th Messrs. Russell & Co., shipbuilders, launched from their yard at Greenock an iron sailing ship of about 1,800 tons net register, and of the following dimensions:—Length, 270 ft.; breadth, 30 ft.; and depth, 24 ft. The new vessel, which has been constructed to the order of Messrs. P. Denniston & Co., shipowners, Glasgow, was on leaving the ways named the *Bandaneira*. She will be fitted out for sea at Port Glasgow.

Princess Maud.—On March 5th the *Princess Maud* was launched by Messrs. D. J. Dunlop & Co., Inch Works, Port Glasgow, for Messrs. M. Langlands & Sons, Glasgow, as an addition to their fleet of coasting steamers. The new vessel is of the following dimensions, viz.:—Length, 208 ft.; breadth, 29½ ft.; depth of hold, 15 ft. She has large passenger accommodation, and every convenience in the way of steam cranes and winches for speedy loading and discharging of cargo, while particular attention has been paid to the arrangements for carrying cattle and horses. The engines, which are from the builders' engine works, are compound surface condensing, having cylinders 28 and 56 in. by 42 in. stroke, which will propel the steamer at a high rate of speed. After a most successful launch the vessel was berthed alongside of the builders' wharf, under their new steam derrick crane, and received the first portion of her machinery on board within 10 minutes from the time she started to move on her launching ways. The ceremony of naming the new steamer was performed by Miss Florence Langlands.

Telamon.—On March 16th Messrs. Scott & Co., Greenock, launched an iron steamer of 2,300 tons burthen, and of the following dimensions:—Length 320 ft.; breadth 36 ft.; and depth 26 ft. The new vessel has been built for the Ocean Steamship Company, of Liverpool, for their China trade. The engines have been constructed by the builders, and are of Holt's tandem design, having cylinders of 27 and 58 in. respectively, with a stroke of 5 ft., and will indicate 1,500 H.P. The boiler, which is of steel throughout, weighs 72 tons, and is fitted with Foxe's patent corrugated furnaces. As she left the ways the new steamer was named the *Telamon* by Mrs. Morgan, wife of the superintendent engineer, and was afterwards towed to the Victoria Harbour, where her engine and boilers will be put on board.

Ville d'Eau.—On March 18th a new twin screw-hopper dredger, of 600 tons, built and engined by Messrs. W. Simons & Co., was launched from their works at Renfrew. It is the second of two duplicate hopper dredgers constructed by this firm for the Entreprise Serrure, France. It has two independent sets of compound engines, steel boiler, and the builders' traversing bucket ladder for cutting shoals and banks. The thwartship head and stern movements are controlled by steam mechanism.

Osprey and Petrel.—On March 18th Messrs. J. M'Kenzie & Co., shipbuilders, Albert Dock, Leith, launched from their yard two wooden steam fishing vessels, named the *Osprey* and *Petrel*. Their dimensions are:—Length, 67 ft.; breadth, 17 ft. 6 in.; depth, 8 ft. 9 in. Both vessels have been built to the order of Mr. J. L. Cunliffe, Edinburgh, and are intended for the deep sea net and line fishing.

Ariadne.—On March 18th Messrs. Archd. M'Millan & Sons launched from their dockyard at Dumbarton the *Ariadne*, an iron clipper ship of 1,200 tons. The vessel is modelled on finer lines than usual, being specially intended for the trade in which her owners, Messrs. Lawrence, Sons & Co., of London, are engaged—that between London and South Australia—carrying fine goods and Government material out and wool home. The *Ariadne* is built and outfitted in the most substantial manner. The masts, bowsprit, and principal yards are of steel, and the standing rigging is of mild steel wire rope, manufactured by Messrs. John Black & Co., Glasgow, and set up by steel screw lanyards.

Laura.—On March 20th there was launched from the Whiteinch yard of Messrs. Aitken & Mansel a screw steam vessel, measuring 207 ft. by 26¾ ft. by 13¼ ft. deep, with a register of 700 tons. The hull has been built of Siemens-Martin steel, and is fitted up with accommodation for about 150 passengers, exclusive of third-class passengers, and is otherwise completed and equipped for the Channel service of the London and South-Western Railway Company, to whose order the vessel has been built. The machinery, which is 200 N.H.P., will be fitted by Messrs. John & James Thomson, Finnieston. The ceremony of naming the vessel *Laura* was performed by Miss Alice Fleming, of Eltham, Kent.

Nosshead.—On March 20th there was launched from the shipbuilding yard of the London and Glasgow Engineering and Iron Shipbuilding Co., Limited, at Govan, an iron barque of about 1,070 tons register. She has been built under special survey to the highest class at Lloyds, with all the latest improvements, to the order of Mr. John Thomson, jun., for Glasgow owners. As she left the ways she was named *Nosshead* by Miss Hay, of Ibrox. After completion, she will take the berth for Sydney as Messrs. Aitken, Lilburn & Co.'s packet for April, under command of Captain Peebles.

Hercules.—On March 21st Messrs. Napier, Shanks & Bell, Yoker, launched an iron twin-screw tug steamer of about 200 tons, named *Hercules*, for the Clyde Shipping Company. This vessel is similar to the well-known tugs *Gulliver* and *Conqueror*, previously built by the same firm. They are all supplied with Rankin & Blackmore's patent twin-screw engines of great power, rendering them specially serviceable for heavy work, and are also fitted with special appliances for assisting at wrecks, &c., when required. The *Hercules* was named by Miss Annie Swan, of Greenock.

LAUNCHES—Irish.

Gaelic.—On February 28th there was launched from the shipbuilding works of Messrs. Harland & Wolff, Belfast, another addition to the White Star fleet. This vessel, which is named the *Gaelic*, is a sister ship to the *Belgic*, which was launched on the 3rd of January last for the same line. The *Gaelic* is the sixteenth White Star liner built by Messrs. Harland & Wolff. Her general appearance corresponds in all respects with that of the well-known vessels of the line, having a yacht-like hull, with ample beam, four masts, square rigged on three, thus providing effective sail power in the event of any breakdown of the machinery fully equal to that of a first-class sailing ship. Like her sisters, the *Ionic*, *Doric*, *Coptic*, and *Belgic*, she has turtle-backs both forward and aft, forming a shelter in wet and stormy weather for the steerage passengers. The captain's cabin is immediately adjoining the wheel-house and bridge. The officers are quartered by themselves in a deck-house on the upper deck forward. The steerage accommodation is in three sections, approached by separate entrances. The single men are all quartered in the main and lower decks forward, and between them and the married people there is the saloon accommodation and engine space. The single women are still further aft, and have their quarters entirely to themselves. A hospital with every requirement is provided for each section, and two on deck for infectious cases. The whole upper deck, fore and aft, forms a promenade for the steerage passengers, the saloon passengers having a special separate deck above this again. The lighting of four steamers of the White Star fleet by electricity having proved a success, the *Gaelic*, with her sister ship the *Belgic*, will be so lit up in all sections. Both ships are divided into eight water-tight compartments, any of which may be penetrated without seriously imperilling the vessel's safety. The provisions against fire are most complete, and an outbreak in any section of the ship can at once be brought into subjection through the agency of both steam and water. The life-saving appliances are also of the most approved order. The *Gaelic* is built of mild steel, the ductile quality of which ensures the maximum of strength and durability. Her dimensions are:—Length, 420 ft.; breadth, 42 ft.; depth, 29 ft. 6 in., and the gross register tonnage about 4,500. She has two double cylindered engines of 400 H.P., also built by Messrs. Harland & Wolff, the steam for which is supplied from three elliptical boilers, working at an initial pressure of 90 lbs. to the square inch, but tested by the Board of Trade to double that pressure, and capable of bearing even much greater pressure than the maximum official requirement. The crank shafts and crank shafting are of steel, and so constructed as to minimise the risk of a break down, the more so as the engines are two distinct and complete machines, capable of being disconnected and worked separately at a reduced speed. She is steered amidships by steam, and has, in addition to the approved ordinary compasses and sounding appliances, Sir William Thompson's patent compasses and sounding machine. Special precautions have been taken for an effective look-out, a bridge forward being provided for the men engaged in that important duty. Shortly after the *Gaelic* was launched she was towed over to one side of the new jetty in Abercorn Basin, the other side being occupied by the *Belgic*, while close by is the *Teneriffe*, launched from the Queen's Island about a fortnight since, and which, like the other vessels, is being prepared for sea with all possible despatch.

TRIAL TRIPS.

Guahy.—On February 10th the trial trip of the paddle steamer *Guahy*, recently built and engined by Messrs. Caird & Co., Greenock, to the order of Messrs. Knowles & Foster, London, for the Companie Bahianna, took place on the Clyde, and was attended with satisfactory results. The measured mile was covered at the rate of 13¾ knots per hour, being 1¼ knot above the guaranteed rate of speed. She proved a very handy boat under her engines, and there can be no doubt that she will make a valuable addition to the company's fleet trading on the Brazilian coast. The steamer leaves for Bahia under the command of Captain Lewe.

Mascotte.—On February 19th the new steamer *Mascotte*, built by Messrs. Ramage & Ferguson, Leith, for Messrs. Geo. Gibson and Co., of that port, for their trade between Leith and Rotterdam, left Leith, and, after adjusting her compasses, proceeded down the Firth as far as Aberlady Bay, where she ran the measured mile. The speed attained was about 13 knots. The *Mascotte* is a vessel of 1,050 tons burthen, is 250 ft. in length, 30 ft. 6 in. in breadth, and 16 ft. 2 in. in depth. She is supplied with compound surface-condensing engines, having cylinders 32 and 60 in. by 42 in. stroke, has large carrying capacity, and is fitted with the latest improvements. The steamer will be commanded by Captain Telford.

Dolphin.—On February 24th the steam trawler *Dolphin*, built at Dundee by Mr. W. B. Thompson, for the Lowestoft Steam Carrying and Fishing Company, had her official trial trip down the Tay. She measures 100 ft. by 20 ft. by 10 ft., and has compound engines (supplied by the builders), which during the trial developed 300 I.H.P. at a mean speed of 11 knots per hour.

Gardenia.—On February 26th the steamer *Gardenia*, built by Messrs. Henderson, Partick, took her trial cruise down the Clyde. Her owners are Messrs. Alexander A. Laird & Co., and she was built to trade between Glasgow and Londonderry. She is 172 ft. long, and has a breadth of beam of 27 ft., while her greatest depth of hold is 12½ ft., and her gross tonnage is about 450 tons. She has ample accommodation for cattle on deck and in the holds, and general cargo, and is also meant to carry passengers. She has compound inverted cylinder engines, with a large steel boiler, fitted up to the requirements of Lloyds and the Board of Trade for a pressure of 90 lbs. per square inch. The vessel sailed down the Clyde, past the Cumbraes, and returned to Greenock by Rothesay Bay. The weather was very stormy, which prevented any calculation of her speed being taken; but notwithstanding the heavy sea she behaved well, and much satisfaction was expressed at the speed with which she sailed.

Snowdrop.—On February 27th the double twin-screw passenger steamer *Snowdrop* left the Seacombe stage to take her trial trip on the measured mile off Waterloo. She is 130 ft. long, 35 ft. beam, and 6 ft. 6 in. draught. She is the second of two sister vessels built to the order of the Wallasey Local Board by Messrs. William Allsup & Sons, Preston, from the designs and under the superintendence of Messrs. Flannery & Fawcus, of Liverpool. Both vessels are built of steel throughout and to the highest class at Lloyds. They are divided into eighteen water-tight compartments, and both main and saloon decks are of teak. The machinery consists of two pairs of engines having cylinders 18 in. and 37 in. in diameter and 24 in. stroke, with two steel boilers working at a pressure of 100 lb. Each pair of engines drives two propellers, one at either end of the vessel. On her trial trip a speed of 12¼ miles per hour was attained, and the vessel proved to be very readily handled. Like her sister ship *Crocus*, she will be fitted with the electric light by the Manchester Edison Company.

Alice.—On February 28th the new wooden steam fishing vessel *Alice*, built by Messrs. Marr Brothers, Leith, and owned by the Forth Steam Fishing Company, went up the Firth of Forth on her official trial trip. She is intended for the deep-sea line fishing, and measures 76 ft. by 18 ft. by 8 ft. 6 in.; she has been supplied with engines of 55 H.P. by Messrs. John Cran & Co., Leith, her consumption of coal being equal to one ton per day. The average speed got on the trial trip was 8½ knots per hour.

Earl of Mar and Kellie.—On February 28th the whaler *Earl of Mar and Kellie*, of Peterhead, which has just been supplied with new engines by Mr. W. B. Thompson, Dundee, made her trial trip down the river. A speed of 9½ knots per hour was attained while running the measured mile, the tide being in favour but the wind contrary at the time. The *Earl of Mar and Kellie* was built at Alloa in 1857, and for many years was employed in the China and Cape trade. Last year she was sent to Greenland as a sailing vessel, and as the owner, Mr. Duthie, intends to employ her in the Arctic seas he has had her strongly fortified and doubled and supplied with steam power, the engines being constructed from specifications prepared by Mr. Alex. Smith, Dundee.

Industrie.—On March 2nd the *Industrie*, the first steamer of the Badische Schrauben-Dampfschifffahrts Gesellschaft, intended to establish a through and direct line between Cologne and London, had a successful trial at Rotterdam. The company was honoured by the presence of Count Pourtales, the representative of Germany at The Hague, accompanied by the German Consul at Rotterdam, and other visitors. The vessel has been specially constructed of steel, 100 A1 English Lloyds, by Messrs. L. Smit & Sons, of Kinderdyk, to carry about 700 tons on the light draught required for the Rhine, and has a pair of powerful twin screw engines of 440 I.H.P. by Messrs. Diepeveen Lels and Smit. She has steam steering-gear, Emerson & Walker's windlass, and their most modern steam gear for working the cargoes, as well as the latest improvements in electric lights on deck and below. She will discharge and load alongside Butler's Wharf. The agent at Cologne is Mr. Massenez, of the firm of H. Milchsack & Co., and the brokers in London are Messrs. Brown, Geveke & Co., 118, Fenchurch-street, E.C.

Malacca.—On March 7th the iron screw steamer *Malacca*, recently built and engined by Messrs. Ramage & Ferguson, Leith, for Messrs. Kim, Seng & Co., Singapore, had her official trial trip on the Forth. She is a vessel of 653 tons register, schooner rigged, classed 100 A1 at Lloyds, and measures 180 ft. by 26 ft. 6 in. by 16 ft.; she is propelled by engines of 125 N.H.P. the cylinders being respectively 28 in. and 54 in. in diameter, with piston stroke of 36 in. Steam is obtained from an extra large double-ended steel boiler, capable of burning wood as well as coal. Loaded to a depth of about 14 ft. she made a double run on the measured mile, attaining a mean speed of 11½ knots, which was very satisfactory. The *Malacca* is to be employed in the passenger and cargo trade in the Straits.

Denbighshire.—The trial trip of the new screw steamer *Denbighshire*, built by Messrs. C. S. Swan & Hunter, Wallsend, for Messrs. D. J. Jenkins & Co., of London, for their London, China, and Japan line, took place on March 7th. The dimensions of the vessel are:—Length, 325 ft.; breadth, 38 ft.; depth moulded, 27 ft.; registered tonnage, gross, 2,538·38; nett, 1,662·98. She has been fitted with engines, by Messrs. R. & W. Hawthorn, of 300 N.H.P., but capable of developing 2,000 I.H.P. They are of the description known as direct acting compound surface condensing, the working pressure being 100 lbs. The mean speed obtained on the measured mile was 12½ knots, which was considered very satisfactory. The owners were represented by Mr. Speed, Captain Sturrock, the commodore captain of the fleet, and Mr. Hudson, the superintendent engineer. After the visitors left the ship, this fine vessel proceeded on her way to London *via* Antwerp, thence to be immediately despatched to China to bring home the new season's teas. The *Denbighshire* is built with a double bottom on the cellular principle all fore and aft, and is sub-divided by eight watertight bulkheads. She is schooner rigged with steel masts, classed 100 A1 at Lloyds, built under special survey, of extra strength, with two iron decks, and treble rivetted shell, &c., and has Board of Trade passenger certificate. The decks are of teak, and all the fittings are of the highest class and finish. Looking along the decks, a visitor is at once struck by the great care that has been exercised to secure the comfort and safety of the passengers and crew. Under the top-gallant forecastle, on each side, the crew and firemen are berthed, while in the centre, on main deck, is the massive direct steam windlass for working the chain cables. An example of the efficiency of this windlass (which is by Messrs. Clark, Chapman and Co.) was seen by the visitors when the captain ordered the anchor to be dropped, the whole process of raising and lowering only occupying a few minutes. The vessel is also fitted with four steam winches and steam crane by Messrs. Clark, Chapman & Co., and hand and team steering gear by Messrs. Davies & Co., Limited, London. The bridge-house amidships, extending over engine and boiler space, is open at ends, having accommodation for officers, engineers, carpenters, galley, sail rooms, &c., within it, with large chart-house and wheel-house above. The poop contains a large and handsome saloon panelled in hardwood, the ceiling being white relieved with gold. The state cabins are on

each side of this saloon, and on the starboard side is a large ladies' cabin, with bathroom and lavatories attached, the whole being handsomely finished and upholstered in velvet. The *Denbighshire* is the second vessel the firm of Messrs. C. S. Swan & Hunter have built for the "Shire" Line, and she is in every respect, in hull and engines, a well-built and first-class ship.

Electra.—On March 12th the new cable steamer *Electra*, built and engined by Messrs. R. Napier & Sons, Govan, for the Eastern Telegraph Company, London, went down the Firth on her official speed trials, which proved most successful. The *Electra* (the second steamer of like character built by this eminent shipbuilding and engineering firm for the Eastern Telegraph Company) has been designed for the special work of laying and repairing telegraph cables, and is specially intended for the Telegraph Company's Mediterranean service. Externally, the steamer has a very symmetrical appearance, having more the look of a smart Trinity yacht than a practical business steamer. Internally, the arrangements (very complicated) are of a singularly complete character, making her one of the most perfect cable ships afloat. To attain the maximum of strength the hull and boilers have been constructed of Siemens-Martin steel, and the bottom has been subdivided into numerous water-tight compartments, which are arranged for water ballast to trim the vessel as the cables and coals are exhausted. The general dimensions of the steamer are as follows:—Length between perpendiculars, 230 ft.; breadth of beam, 32 ft.; depth of hold to awning deck, 24 ft.; with a tonnage of 1,150, and classed at Lloyds 100 A under special survey. As the steamer is intended for the service between England and the Mediterranean, where rough weather is often experienced, she has been constructed with an awning deck, under which the accommodation for the officers and crew is placed, while the cable tanks occupy the holds. The gear for paying out and picking up cables is of the most modern and complete description. It consists of double shears and guards, which have been built into the bow of the steamer, and have been wrought into the design with a graceful cutwater stem. The double combined picking up and paying out machine with holding back and draw off gear is driven by a pair of powerful engines, and the necessary dynamometers, lead wheels, davits, stopper hooks, &c., have all been provided. This gear has been constructed by Messrs. Johnstone & Phillips, London, who have also fitted the electric light all over the ship, as well as arc lights and a powerful search light on the bridge. The driving apparatus consists of four dynamos and two Williams's engines, making a complete duplicate set. The accommodation for the officers and crew is of the most ample description, and is the outcome of much careful consideration by the directors of the company. As the vessel will occasionally have to remain at sea for long periods, it is desirable that everyone on board should be made as comfortable as possible, and as rough weather is often experienced all the officers and crew have their quarters under the shelter of the awning-deck. The saloon, which is aft, has been tastefully fitted up in polished wainscot teak of different shades, with fluted walnut pilasters and gilded capitals and cornice. At the forward end there is a handsome oak sideboard, with marble top and bevelled glass mirror above, while round the tables are placed walnut revolving chairs, which along with the sofas at the sides are upholstered in green haircloth, with artistic tapestry curtains at the doors and windows. The steamer has also been provided with patent compasses and sounding machines. The steam steering-gear and steam capstan windlass have been supplied by Messrs. Davies & Co., of London, and both worked smoothly and to every one's satisfaction; they are similar to a great many supplied by this firm for cable ships and other large vessels. "Kirkaldy's" distillers, capable of condensing 15,000 gallons per day, admirably adapt the steamer for becoming a condensing ship for troops. As important repairs have sometimes to be made, a very complete engineer's workshop has been fitted with lathes, screw-cutting machines, verticles, &c. The engines of the steamer consist of a pair of compound surface-condensing, capable of indicating 1,250 H.P., steam being supplied by two single-ended steel boilers; and the most recent improvements have been introduced to attain economy and efficiency. At the trial on the measured mile a mean speed of 12·75 knots was obtained on four runs, which was considered most satisfactory. A select company of gentlemen were invited to accompany the steamer, and the weather being of the most enjoyable description for the season of the year, a delightful day was spent. Amongst those present were Messrs. John and James Hamilton (Messrs. Napier & Son), Mr. Jos. Birnie, designer of the steamer; Mr. A. Beldame, who superintended the engines; Mr. D. J. Dunlop, shipbuilder; Captain Pattison, who is to command the steamer; Mr. R. W. Renwick, Telegraph Company's superintendent in Glasgow; Mr. C. M'Whirter, London; Mr. J. Brockie, &c. After the trials dinner was served in the saloon, Mr. J. Hamilton presiding. In proposing "Success to the *Electra*," the Chairman expressed the great pleasure and satisfaction his firm had experienced in building the two steamers for the Eastern Telegraph Company, and complimented Mr. Birnie on the carefully-prepared plans and specifications which he had submitted, enabling his firm to execute a kind of work hitherto almost unknown to shipbuilders on the Clyde, with an amount of completeness and satisfaction which was creditable to all concerned. (Applause.) Mr. Birnie, on behalf of the company, expressed the gratification he felt at two such fine steamers having been so admirably completed by Messrs. Napier's firm, and paid a high compliment to the builders and engineers for the ability they had displayed in mastering and overtaking the construction of a class of steamers so different from the ordinary type of vessel built on the Clyde. Other toasts followed. After landing the company at Prince's Pier, the *Electra* proceeded to London, where she will ship her cables and stores, and will thereafter start on special service to Suakin, on the Red Sea, under command of Captain George Pattison, late of the company's steamer *Volta*.

Condor.—On March 12th this powerful screw tug, built by Messrs. Morton & Co., of Leith, had a trial trip on the river Thames. The *Condor* was built to the order of, and was designed by, Messrs. Watkins & Co., of 121, Fenchurch-street, London, and fitted with their improved sluice keel to facilitate turning. The dimensions and power of the *Condor* are as follows:—Length, 90 ft.; beam, 19 ft.; depth of hold, 11 ft. 3 in.; fitted with engines of the compound surface condensing type; cylinders, 20½ in. and 40 in. by 24 in. stroke; large multitubular boiler, working pressure 100 lbs. The *Condor* left Blackwall at 11 a.m., and proceeded at full speed to sea, each of the engines working admirably the whole time. Experiments of handiness were tried at various times, proving the great advantage of Messrs. Watkins and Co.'s improved sluice keel. She is classed 100 A 1 at Lloyds, and has all the latest improvements.

Damara.—On March 12th the new steamer *Damara*, built and engined by Messrs. Alexander Stephen & Sons, Linthouse, Glasgow, for the Halifax Steam Navigation Company, of Nova Scotia, had her official speed trials on the Clyde. The speed attained on the measured mile was 12 knots, the vessel proving herself to be satisfactory in every respect. She is exceptionally strong, having no fewer than seven water-tight bulkheads. Her engines are of 200 N.H.P., the consumption of coal being only 17 tons per twenty-four hours. She is intended to run between Canada and Havre, under contract with the Dominion Government of Canada.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

BOARD OF TRADE EXAMINATIONS.

To the Editor of The Marine Engineer.

Sir,—Would you kindly allow me, through the medium of your valuable journal, to suggest that the time has now arrived when the second question in Examination 15 B of elementary questions for first examinations of engineers for certificates of competency, viz., "How long have you served as fireman or trimmer?" should be taken into consideration by the Board of Trade, relative to its entire removal. It has now been in force since April, 1873, some twelve years, during which time it has done much to lower the Profession. I maintain that the engineer staff of the Mercantile Marine should now consist only of men who have received a practical training at the making or repairing of engines.

I will ask you to contemplate the anxiety of a chief engineer sent to sea on a long voyage, when he finds that his second and third are nothing more than men who have served their time at the shovel, instead of the hammer, chisel, and file. I can assure you it is a great relief for him to be in charge of a pair of engines that enable him to get from port to port in safety. It is also a great hardship for those who have been legitimately trained by their parents for marine engineers to find they could have attained the same position without that trouble and expense, by simply going to sea for four years as fireman or trimmer to develop into a full-blown engineer. We know these men are obtainable at a cheaper rate, and when out of a ship they act as skilled labourers or engine fitters' assistants. They are able to drive an engine (so are locomotive drivers); as for maintaining the efficiency of the machine, they are just as useless. Now, Sir, apologising for occupying so much valuable space in your journal, I must conclude by trusting that the above may be noticed by some of more power than myself, and that certificates of competency will be granted to those only that can show proof of practical training to qualify them to hold the position of a

MARINE ENGINEER.

THE POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—It gave me great pleasure to read the very sensible remarks made by your correspondent "Chief Engineer," under the heading "Crank Shafts," in this month's issue of your interesting paper, and I feel sure they will be endorsed by the majority of sea-going engineers.

It must stand to reason that the longer an engineer stays on one vessel, the more interest will he have in his engine, and the more will he endeavour to keep his engine in good working order, as much for his own satisfaction as for the interest of the owners; for any true engineer will take as much interest in his engine to keep it in good condition, as will any florist with his flowers, or any trainer with his favourite horse. But when you have engineers never certain of being two voyages in the same ship, how can they be expected to take much interest in the welfare of the machinery? When they find anything beginning to go wrong they will say, "Oh! well, it will last as long as I am in the boat, and then the next man can find it out for himself"; and so the evils commence, and so they go on, until a serious accident occurs, and a break-down at sea. But let owners and superintendents be a little more considerate, and try and make their engineers as comfortable as circumstances will permit, give them comfortable berths and good money, and they will get good men, and these men will stop in their ships, and it will be as a home to them. Engineers, at the best, have a hard life when at sea, and a great deal of responsibility rests upon them, and by a slight neglect may be the cause of a loss of several hundreds of pounds to the owners, whilst, on the other hand, they may be the means of a heavy saving in the owners' pocket. Therefore I say to owners, "Look after your engineers, and they will look after you."

There is also another point upon which I should like to see somebody better than I use their pen, and that, Sir, is in reference to third engineers. Why not have certificates of three grades, and make all engineers before they are allowed to take a watch in an engine-room pass a slight examination as to their practical knowledge? This would keep out of our ranks all "Shovels," as well as other men who never try to rise to a certificated engineer.

What difference is there between the second engineer of a boat of 98 H.P., and the second of one of, say, 130 H.P., in regard to his duties, either when the ship is at sea or in port? and yet the former one may be any ignoramus that they have been able to find at the last thing when the ship was ready for sea, and he may know about as much how to properly manage an engine as "a pig knows about his uncle," and that is not saying very much; and yet this man has under his supervision for twelve hours in the day, the engines and boilers (and one might say, lives of the men) of the ship he is in.

Therefore, let the Board of Trade compel every one before they are allowed to sign articles as engineer on board a ship, pass a slight examination as to their knowledge, and it will be to the interest of all concerned.

Trusting you will be able to find room for these few remarks, and that the matter will be taken up by those concerned, I beg *to remain*, yours truly, A SEAGOING ENGINEER.

North Shields, March 20th, 1884.

Reviews.

Hilfsbuch für den Schiffbau. By Von Hans Johow. Berlin: V. Julius Springer.

THE work is written with the object of bringing before the student connected with the designing and construction of steam ships and ships' engines, such theories, tables, and data as may be of especial use to him in his profession, and these have been so far amplified, both in regard to their number and the subjects they embrace, as to render them also of service to the steam and navigating officers of war and merchant ships, and to all who may be connected with marine engineering generally.

The work testifies to the deep research of its author, and is altogether one which we can highly commend to our readers, though its being written in German may not tell in its favour with some of them. An extensive set of tables on various subjects and many useful data are given, and in his selection of these the author has been guided rather by their practical utility than by any deference as to their authors.

The book is got up in a style which contrasts very favourably with some of our best English books, and, indeed, some of our publishers might profitably take a lesson from it. We think the work well worthy of translation into English, and we shall hail its appearance in our language with great pleasure.

The Marine Engineers' Annual and Almanac for 1885. Liverpool: D. M'Gregor & Co.

WE have pleasure in noticing this—the tenth annual—edition of *The Marine Engineers' Almanac*, which is fully up to any of the previous editions for fulness of information on every point of interest to the marine engineer.

In a book abounding with so many short and pithy articles, it would indeed be a difficult task to single out any particular one for special notice, but perhaps the one relating to the action of the Government in reference to the loss of the *Nisero* may be quoted as a plain and straightforward piece of English well worthy of careful perusal.

No doubt the "Log Book of Dates," with its appendix and the records of "Fast Passages," will prove interesting reading to marine engineers generally, to all of whom we cordially recommend the book.

The Engineers', Millwrights', and Machinists' Practical Assistant. By W. Templeton. London: Crosby Lockwood & Co.

THIS handy little volume forms one more addition to the already very extensive array of books of reference designed for the use of engineers generally. It is the seventh edition of the same author's work on the subject, and besides having been thoroughly revised and brought down to date, it possesses several features of novelty and utility which will, we have no doubt, favourably commend it in the estimation of our readers.

One of these features consists in extending the usual table of diameters, circumferences and areas of circles, so as to include the squares and cubes of the diameters, and the lengths of the side of a square having an equal area to the areas given.

The short articles on "Steam and the Steam Engine," and "The Steam Boiler," form a valuable addition to the book.

The book is of a small and convenient size for the pocket, and from its lowness of price (2s. 6d.), and the fact of its having a number of blank pages for notes, will no doubt become popular with the very numerous class for whom it has been written.

A Representative Catalogue of Machinery, Machine Tools, and Engineering Material. Prepared by Messrs. John Birch & Co., Engineers and Merchants, Liverpool.

WE have now before us one of the most comprehensive and neatly got up trade catalogues that has come under our notice for some considerable time. When we state that the book comprises over 200 pages, equal in size with those of the *Marine Engineer*, and contains close upon 800 illustrations, it will, we think, go without saying that almost every class of machinery is well represented in it. As a matter of fact, we find included in its ample scope such very diverse articles as wheelbarrows and railway stations, split cotton pins and compound surface condensing marine engines, gauge glasses and steam hammers, drill chucks and

steam launches, &c. The above briefly enumerated items would alone constitute a valuable book of reference in themselves, but the book has other claims for our consideration, in that it differs from the general run of trade catalogues inasmuch as it contains a series of most useful articles on the various manufactures and qualities of iron and steel as made in each of the great centres of the iron and steel industries; a number of tables of weights and measures in general use; tables of breaking strains of wire, rope, joists, cables, &c.; various wire and sheet gauges; weights of different metals, and a mass of other matter which must prove useful to engineers, especially those stationed abroad.

Phosphor-Bronze and Silicium-Bronze. The Phosphor-Bronze Company, Limited, 87, Summer-street, Southwark, S.E.

This small pamphlet, which calls for our attention, is issued by the above named company and deals with their now well-known products of phosphor-bronze and silicium-bronze. Though the pamphlet is devoted exclusively to describing the application of these metals to telegraphic and telephonic purposes, yet we find in it one or two facts the recapitulation of which will no doubt prove of interest to our readers. The first of these is the enormous tensile strength of wires when made from the company's products as compared with wires of iron or steel; and the very extended and increasing use of these for telephone and telegraph wires. Another and equally significant fact for our readers is the great power these metals possess in resisting oxidation. This is amply and sufficiently exemplified in the case of two long spans of phosphor-bronze wire which were used to cross the channel separating the Mumbles lighthouse from the headland near Swansea. These were erected in 1879, and though, of course, constantly exposed to that most active form of oxidation, the sea spray, it was found on examination in November, 1883, that not the slightest change was noticeable in the wires.

Bergen's Marine Engineer and Guide Book to the Board of Trade Examinations. By M. Metcalfe. North Shields: W. J. Potts.

We recommend this book to those marine engineers who are going up for their examinations as first or second class engineers, containing, as it does, all the latest questions and requirements of the Board of Trade for their examinations.

In this, the fourth edition, we notice that many valuable improvements have been made throughout the work, and these, together with the large number of plates of various parts of engines, and the copious number of illustrations interspersed throughout the text, leave scarcely any part of the marine engine which is not only thoroughly well explained, but also adequately illustrated, a matter of almost equal importance. Under the hands of so experienced and practical an editor, we need scarcely say that these illustrations have been prepared with all due accuracy of detail and suitability to the subjects treated, nor need we say that the work throughout evinces a full and personal knowledge of the subject which a long and varied experience has enabled him to write with, and we are confident that the proprietor will not be disappointed in his hope that the present edition will be found to be a thoroughly concise, complete, and comprehensive guide-book to the sea-going engineer in preparing for certificates of competency.

As showing how fully the subject is dealt with, we may mention that the work is divided into fourteen main parts, under the following headings, viz.: Rules and Regulations of Examination, and here are given some most valuable hints to engineer candidates; Arithmetic; Algebraical Formulæ; Arithmetical Questions; Lengths, Heights, Breadths, and Numbers; Areas and Volumes; Weight; Weights of Material and different Parts of an Engine; Force and Friction; Pressure; Strains; Temperature, Densities, and Heat; Horse Power; Revolutions, Speed, &c.; and Work done by Pumps.

In addition to all these there is given much useful information on many various subjects, too numerous for classification by us, but all of which will prove of the utmost utility to the marine engineer generally.

One more valuable feature of this work is the admirable atlas, containing twenty-five large plates of fully dimensioned drawings, and numerous examples of indicator diagrams, and these instead of being inserted in the book itself are bound up separately, as stated, and attached to the back cover of the book by means of a broad elastic band. By this means any one drawing can be readily referred to without that constant source of annoyance, the turning backwards and forwards of the pages on which appears the description of the figures referred to.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from February 20th to March 19th, 1885.

1952 W. J. D. Walker. Condensers.
1971 T. Rounthwaite. Vertical steam boilers.
1979 W. Lowrie. Steam and other engines.
1981 H. Davey. Low pressure steam motor.
2014 H. J. T. Ford. Preservative composition for the bottoms of iron ships.
2024 Johnson (A. Normand & Co.) Smoke tubes of tubular steam boilers.
2053 H. C. Ashlin and H. Turner. Compound engines.
2058 S. R. Hawke. Water lifting appliances.
2082 W. L. Williams. Low water alarms for steam boilers.
2086 T. & D. McCulloch and T. White. Valve gear.
2103 J. Roots. Engines.
2128 J. Kirkaldy. Heating feed water.
2156 J. McHardy. Towing and anchoring of ships.
2173 T. Kay. Making sea water drinkable.
2197 J. C. Martin. Obtaining motive power.
2226 R. Harrison. Ship's berths.
2230 J. H. Tangye and W. Johnson. Automatic cut off for slide valves of steam engines.
2232 C. Blagburn. Water velocipede.
2234 E. Field. Engines to be worked by steam.
2235 S. Smith. Valves.
2236 H. S. Greenwood. Variable automatic expansion motion for steam engines.
2249 W. B. Thompson. Removing water from the ballast tanks of ships.
2250 F. R. Lipscombe. Filtering.
2255 Lake (J. Smelts). Cylinders.
2268 M. H. Smith. Differential gearing.
2276 S. S. Allin. Construction of water motor.
2284 E. O. Peck. Slide valves for steam engines.
2289 A. Wilson. Furnaces.
2296 Boult (M. Nougues). Canals.
2299 J. A. Macmerkan. Regulating the draught in boiler and other furnaces.
2302 Montegelas (A. Prüsker). Measuring.
2303 Abel (J. & C. Haswell). Furnace for steam boilers.
2309 F. P. Warren. Preventing ships foundering.
2320 I. & S. Smith. Steam safety valve.
2335 J. H. Barry. Telegraphing from light ships.
2345 Groth (C. Piefke). Filtering.
2352 J. G. Lorrain. Filtering.
2355 W. J. D. Walker. Condensers.
2356 Froom (V. J. Kalashnikoff). Vertical boiler.
2362 W. S. Sutherland. Steam engines.
2369 E. Rost. Lubricators.
2370 W. J. L. Stewart. Lubricators.
2372 W. Kinley. Measuring the pitch of screw propellers.
2376 J. P. Wilson. Steam steering-gear.
2380 J. Steven and T. Burt. Lubricators.
2388 W. C. Johnson and S. E. Phillips. Machinery for paying out or picking up submarine cables.
2394 Whiteman (I. Ramboux). Producing motive power.
2397 Boult (F. L. McGahan). Lubricators.
2410 J. Ahlstedt. Water or other fluid pressure engine.
2419 J. Lapsley. Engines.
2422 J. B. Edmiston. Condensers.
2426 J. F. & M. Rankin. Disconnective compound steam engines.
2472 T. T. Crook. Vertical boilers.
2477 M. G. Farmer. Repeaters for submarine cables.
2479 J. H. Northcott. Reversing gear for steam and other engines.
2483 C. T. Beilby. Motive power engines.
2484 W. Harvie. Ship's riding lights.
2486 Reed (T. Barbor). Pistons for steam engines.
2487 Reed (A. Jackson). Balanced slide valve.
2514 H. Cutting. Steam engines.
2525 J. Dean. Intermediate driving gear for paddle wheels.
2530 Budenberg (Schäffer & Budenberg). Regulating the supply of steam to engines.
2531 G. Cawley. Valve gear for steam and other engines.
2569 J. Campbell. Ventilating cowls for ships.

2570 J. Auld. Actuating the dampers of steam boiler furnaces.
2588 Barlow (J. S. Meyer). Removing incrustation from steam boilers.
2595 C. Davy. Hydraulic valves.
2601 R. F. C. Tonge. Valves and cocks.
2627 A. Eiloart. Cocks or valves.
2635 Clark (J. Mallie). Filtering.
2643 Boult (J. Abell). Steam boiler and other furnaces.
2644 C. Price and H. Cleave. Filtering.
2646 J. F. Phillips. Rotary apparatus applicable as a pump or motor.
2655 W. Telfer and R. King. Screw propeller blades to resist corrosion.
2662 H. Aitken. Scale in boilers.
2663 H. Aitken. Valvular arrangements for preventing the passage of steam.
2666 H. T. Wedlake. Compensating valve.
2668 J. Gamgee. Motive power.
2675 Groth (F. Almquist). Speed indicator for marine or other engines.
2683 J. A. & J. Hopkinson. Tubes or flues for steam boilers.
2686 R. Matthews. Trip valve gear for steam engines.
2694 C. T. Bullough. Regulating the supply of steam to engines.
2707 E. C. H. Samsche. Steering vessels.
2713 F. B. Dœring. Purifying water of steam boilers.
2737 Barlow (E. Grube and T. Lehmkuhl). Lubricators.
2746 A. J. Bell. Filtering.
2769 Boult (F. Barrufel). Utilizing the power of waves.
2797 G. Best. Condensing steam.
2804 W. S. Page. Vessels or floating reservoirs.
2809 Alexander (H. E. Foster). Boat detaching apparatus.
2811 C. A. Knight and G. W. Thode. Steam boilers.
2820 W. Brown and C. N. May. Valve for pumps.
2840 J. Proctor. Supplying steam boiler and other furnaces.
2854 H. Holden and R. G. Brooke. Automatically turning on steam.
2902 R. Young. Pump lubricator.
2911 H. C. Williams. Compasses for ships.
2921 Hadden (P. Porte and C. Dubroca). Increasing the heating effect of steam.
2928 H. Roberts. Lubricators.
2943 T. Dipple. Valve cocks.
2974 D. Purves. Furnaces for steam boilers.
3002 J. J. Royle and M. Mitchell. Indicating the water level in steam boilers.
3004 J. C. Sellars. Construction of cables.
3008 H. Callas. Appliance for steam boiler furnaces.
3017 W. & J. Beesley. Propulsion of ships and other vessels.
3035 F. Roland. Motor without boiler.
3040 W. Lowrie. Steam and other engines.
3063 J. Gunther. Lubricators.
3090 F. L. McGahan. Boiler flue cleaners.
3123 O. D. Orvis. Consuming smoke and gases in steam boilers.
3143 Haddan (R. H. Cowdrey). Multiple cylinder engines.
3144 Haddan (R. H. Cowdrey). Steam engine valves.
3145 Haddan (R. H. Cowdrey). Steam valves for engines.
3146 Haddan (R. H. Cowdrey). Steam engines.
3153 A. Dobson. Expansive gear of steam engines.
3165 Thompson (A. Backus). Furnaces.
3173 J. E. Bond. Rotary engines.
3178 Groth (S. Achleitner). Motor for vehicles and boats.
3182 H. Hodgson. Operating the valves used in and in conjunction with steam engines.
3184 J. H. Tattersall. Stop valves.
3195 J. Chater. Automatic steam pressure and water level recording machine.
3205 L. C. Caspersen. Preventing corrosion in steam boilers.
3211 H. Brecknell. Safety valves.
3221 C. F. Wright. Pressure and vacuum gauges.
3236 R. W. Harrison. Packing for steam engines.
3256 J. Evans. Pumping engines.
3271 W. Bow. Compound pumping engine.
3301 Boult (R. Guillaume). Dredging.
3302 W. Clarke. Ship's windlasses.
3304 W. Ritter. Feed water regulator for steam boilers.
3307 W. Schmidt. Steam engines.
3311 Ridgway (F. Geshwend). Steering ships.
3312 H. Davey. Double acting pump.
3322 J. Beatty and J. Rebbla. Propelling steamships.
3335 *J. A. Drake. Steam* and other engines.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

February 21st, 1885.

Bernsten, W. F.	1C	Cardiff
Boyd, T.	2C	N. Shields
Cattelle, W. A.	1C	Liverpool
Chalmer, J. A.	1C	,,
Chalmers, J.	2C	Aberdeen
Darling, H.	2C	London
Dick, J. B.	2C	,,
Evans, D.	2C	Cardiff
Ewart, G. R.	2C	N. Shields
Glen, J.	1C	London
Hackett, J. E.	1C	Liverpool
Hall, J.	2C	Aberdeen
Hutchinson, J.	1C	Snderland
Hutchinson, J.	2C	Liverpool
Jenkinson, T.	2C	,,
Ker, J. M.	2C	London
Kingswood, R. W.	1C	,,
Lee, J. E.	2C	Liverpool
McGillivray, C. G.	2C	Aberdeen
Morgan, J. J.	2C	Cardiff
Murray, G. Y.	1C	Snderland
Murray, D.	2C	N. Shields
Seaton, W. T.	1C	Hull
Sturdy, F.	2C	,,
Thomas, W. O.	2C	Liverpool
Thomson, R.	1C	,,
Walker, A.	1C	Snderland
Waters, R. R.	1C	Cardiff
Weir, P.	2C	London
Willdey, A. E.	2C	,,
York, C. P.	1C	Cardiff

February 28th, 1885.

Birkett, J.	E1C	London
Clarke, H.	2C	Glasgow
Clucas, W. H.	1C	Liverpool
Dunn, H. E.	1C	London
Gavin, A. E.	1C	,,
Gibson, W. H.	2C	N. Shields
Greenhill, W.	1C	Dundee
Grieve, D.	1C	,,
Grieve, J.	2C	Glasgow
Haberland, G. H.	2C	N. Shields
Hardie, A.	2C	Glasgow
Harris, R.	1C	Dundee
Knudsen, I.	2C	N. Shields
Lapsley, G. S.	1C	Glasgow
Llewellyn, W. J.	1C	Liverpool
Mackintosh, E.	2C	Glasgow
McDonald, W.	1C	N. Shields
McKenzie, D.	1C	Glasgow
Murray, T.	1C	N. Shields
Peters, D. B.	2C	Dundee
Petrie, J. McC.	1C	Glasgow
Poole, W.	2C	Bristol
Porteous, A.	1C	Glasgow
Rayner, J. B.	2C	Liverpool
Richardson, R.	1C	Dundee
Simpson, J.	1C	Glasgow
Sutherland, R.	2C	N. Shields
Thomas, E.	2C	Belfast
Thompson, A.	2C	Bristol
Thomson, W. M.	1C	Dundee
Tod, J.	2C	Belfast
Walker, F. M.	2C	N. Shields
Walters, R.	2C	Liverpool
Wright, J.	2C	Glasgow

March 7th, 1885.

Anderson, R.	2C	Hull
Blair, J. C.	1C	London
Burges, W.	1C	Leith
Campbell, W.	1C	Greenock
Clayton, W. J.	2C	London
Dunn, J.	1C	Leith
Ford, W. F.	2C	,,
Hall, J.	1C	,,
Halliwell, J.	2C	Hull
Hance, A. C. B.	1C	London
Leask, A. R.	1C	Leith
McBride, W.	1C	Hull
McIntyre, W.	1C	Liverpool
McNaught, J. W.	2C	London
Miles, W. E.	2C	,,
Miller, C.	1C	N. Shields
Richardson, G.	2C	Leith
Robertson, J.	2C	,,

March 14th, 1885.

Beels, B.	1C	Hull
Blythe, J.	2C	Liverpool
Brimer, I.	1C	N. Shields
Brodie, A.	1C	Glasgow
Brown, J.	2C	N. Shields
Buck, H. T.	2C	London
Buckmaster, H. G.	2C	,,
Bydder, C.	1C	Cardiff
Carnie, C. T.	1C	Glasgow
Dabb, E. V.	2C	Cardiff
Denby, P.	2C	,,
Elder, M. E.	1C	Liverpool
Farquharson, A.	2C	Glasgow
Gifford, J.	1C	Leith
Harris, A.	2C	Glasgow
Henderson, A.	1C	,,
Honneyman, W.	2C	N. Shields
Howell, R. G.	2C	London
Houston, C.	1C	Glasgow
Hunter, J. G.	2C	N. Shields
Jackson, J. C.	1C	,,
James, E. C.	1C	Cardiff
Kay, J.	2C	,,
Laidler, W.	1C	N. Shields
Lloyd, E. T.	2C	Liverpool
Mawdsley, W. C.	2C	,,
McAlpine, J.	2C	Glasgow
Meade, A. P.	2C	,,
Menzies, A.	2C	London
Owens, R.	2C	Liverpool
Patterson, J.	2C	London
Phillips, F. H.	1C	,,
Saunders, W.	2C	Cardiff
Schofield, H. R.	2C	N. Shields
Shepherd, H.	1C	Liverpool
Silversides, R. H.	2C	London
Smith, J.	1C	Glasgow
Stout, O.	1C	N. Shields
Taylor, J.	1C	Glasgow
Thomas, W.	1C	Cardiff
Thomas, S.	2C	,,
Thompson, J.	1C	N. Shielps
Thomson, F. J.	2C	Hull
Woods, A. R. T.	1C	Liverpool
Young, J.	1C	Glasgow
Young, W.	2C	,,
Young, J.	2C	London

NOTE.—"*Launch of a Japanese Warship on the Tyne.*" *For want of space we are compelled to hold over this article till next month.*

The Marine Engineer.

LONDON, MAY 1, 1885.

EDITORIAL NOTES.

IT is an ill wind that blows nobody any good, and however disturbing the present rumours of war may be to ordinary trade, they have had a very great stimulating effect on the production of our shipbuilding and marine engineering yards throughout the country. Most of the London marine engineering firms are now working overtime, up till 10 o'clock at night, manufacturing engines of all descriptions and sizes, to meet the present demand for increase in torpedo vessels, and other light cruisers. On the Clyde also great activity is shown in the chief building yards, owing to orders for swift cruisers having been placed with some of the best known shipbuilding firms there. The shipowners also must feel rejoiced at the considerable demand, at a good profit, for the fast liners, which are being bought up or chartered by the Government for commission as seagoing cruisers. The general rise in freights also from the Black Sea, the Baltic, and America, must be very refreshing to those who have so long suffered from a great and general depression in freights. Should war result, the great demand for cruisers on the part of the Admiralty, and the general rise in freights, will go far to recoup the shipping community for all the losses that they have suffered during the past few years; and should the present scare pass over without any disastrous continental war, we still think that the great demand for fast seagoing cruisers now forced upon the Admiralty by the nation at large, will do much to take up some of the unemployed and the surplus tonnage at present hanging so heavily on the shipowners' hands, and thus cause a permanent revival of activity among the shipbuilders and marine engineers. It is, however, encouraging to the nation at large to hear of the officers and seamen from the mercantile marine belonging to those vessels which have been chartered by the Government temporarily for cruising purposes, coming forward to a man, as volunteers for service in the auxiliary navy so created. We have not the slightest doubt that should war with Russia ensue, vast as our maritime commerce is, we shall be amply able to protect it so long as there are such splendid cruisers to be had from our mercantile marine, and such gallant sailors from the same quarter to be found to man them.

THE Manchester Ship Canal seems to be very strongly opposed, by what we should consider to be the strong vested interests of those who think they are likely to be injured by the carrying out of the new undertaking, rather than by substantial objections to the practicability of the scheme. It seems to us that all the arguments adduced as to the possible effect upon the lower portion of the estuary of the Mersey, by the deepening or modifications of the water channels in the upper part of the river, to render it navigable, are of no force whatever. As to the probable effects of any modifications of the upper river upon the bar at the mouth of the estuary, it has usually resulted from the deepening and straightening of the channels of watercourses that the scour is thereby rather improved than deteriorated, and that such channels as do at present exist over the bar would be thereby improved and better maintained, rather than injured. The fixing of the channels also in the upper estuary need in no way be unsightly; and it is scarcely to be expected in this utilitarian age that any argument founded upon the sentimental objection of interference with nature, however beautiful such nature may be, will bear any weight with practical promoters, or with the legislators, for a scheme which promises great benefits to a large commercial emporium. We certainly think that the present system of parliamentary bills, and the expense in prosecuting and opposing to which such a system gives rise, has now become an abuse, enormous sums being spent in this way and to very little practical purpose such as often suffices to overweight an industrial enterprise with dead capital at its outset. A scheme is almost certain to be best tested, as to its eventual success or financial effect upon trade, by its reception in the money market. If the money is forthcoming to carry such a scheme out, there can be little doubt that its probabilities of success are great, and that the opposition of vested interests or bigoted prejudices is merely factious in its character and a great loss to the country at large, whether from the delay afforded by such opposition or the expense required to overcome it. We have little doubt that the Manchester Ship Canal will come into practical existence sooner or later, as it has been so vigorously supported by financial circles who are in every way most competent to judge of its probable benefits and success; but it is irritating in the meantime to see the constant and factious opposition afforded to such an undertaking by a vested minority.

Some very interesting papers have lately been read at the meeting of the Institution of Naval Architects. One of these, on the propelling machinery of high speed ships, by Mr. E. A. Linnington, is well worth our attention. Mr. Linnington gives us some valuable information upon the special considerations governing the design of high speed cruisers. It is worth notice that the conditions of such high speed cruisers and the ordinary fast commercial liners are essentially different, in that the commercial liners the highest possible speed is required for average development throughout the whole of the run at as an economical a rate of fuel consumption as possible. This economy is desirable, nay, almost a necessity, in commercial liners, for many reasons, amongst which we may specify the small quantity of coal which is required to be carried and the small amount of labour that is necessary to feed the fuel for an economical set of boilers in comparison with more wasteful boilers. In all cases then in the commercial marine, the maximum speed must necessarily be developed economically, or the vessel would be a commercial failure. In the cruiser, on the contrary, the conditions controlling the construction of the fast liner are no longer of vital importance. Unlimited labour is at command for the purpose of stoking, and fuel can be carried in very large quantities without commercial detriment and the carrying capacity of the vessel, and it is probable that a cruiser might often be steaming at a comparatively low speed for days together and the development of its greatest speed would only be required on special occasions and for a limited time. During such a forced effort of speed the question of economy in consumption ceases to be of any importance to the cruiser, the great necessity being the capability of running at a very high speed for a short period when desired. This desideratum is obtained in the cruisers specially designed for the purpose by working the engines ordinarily at slow speeds and with low boiler pressure at high rates of expansion. These conditions serve for the ordinary requirements when merely cruising. When a high speed is required, such as sixteen or eighteen knots, a forced draught is employed, and a consequent very great increase of evaporation is produced, the engines being then run at a very much higher piston speed, with a large initial pressure. The engines of a large number of cruisers now building are intended, so states Mr. Linnington, to work with a piston speed of 750 to 820 feet per minute when at full power. The mean pressure is also maintained at a high average as compared with the initial, which gives a large development of work with a cylinder of small diameter, and, consequently, with light reciprocating parts. Of course, working under these conditions, with forced draught and low rate of expansion, means working far from economically; but this, as we have before mentioned, is a matter of minor importance, compared with the capability of high speed when required. We think, however, that much may yet be done with advantage by the builders of our ironclads or sea-going cruisers to obtain a nearer approximation of speed compared with horse-power and displacement. In the fast Atlantic steamers the proportion of indicated horse-power seems to be about equal to the displacement, whilst in our cruisers the proportion is usually somewhat twice the displacement, but the Atlantic liners obtain as great a speed for the smaller proportion of power to displacement as the cruisers do for double that proportion. This is, no doubt, due to the design of the hulls being much fuller in the armoured cruisers than in the Atlantic liners. We do not, however, consider, judging by what has been effected by private builders for foreign Powers, that it is impossible to obtain nearly as good sea-going qualities for speed in the armoured hull as in the ordinary Atlantic liner.

One of the new developments of modern warfare has been the great increase in the demand for chains. The Admiralty are now making requisitions for hundreds of tons of shackles, rings, and chains, which are to be employed in the construction of iron netting or link armour, to be thrown over the sides of gunboats as they lie at anchor, to prevent successful contact by torpedoes. Most of these orders have gone to the chain makers in the Cradley, Oldhill, and surrounding districts. It is stated also that further inquiries beyond the ordinary requirements of the Admiralty are daily coming to hand, which it is believed are on account of the Russian Government. It is curious to see the rapid development and the steady increase of importance that is now being attached to this new department of warfare, namely, that of torpedoes, and we think, as we have before said, that torpedoes promise to become one of the most powerful factors in future marine warfare.

On the outbreak of war with Russia or any other maritime Power, every fast ship of the enemy will probably attempt destructive operations against our commerce, and but for the wise policy of the Admiralty in securing a number of our fastest and most useful merchantmen as auxiliaries to the Navy, our loss of ships, men and cargoes in warfare would be infinitely greater than it would be if we entirely depended on our warships as hostile cruisers capturers and destroyers, as there

is not a ship in our Navy at the present time which can act in this capacity, owing to lack of sufficient speed and coal endurance. Some of these acquired merchantmen will be used as armed cruisers, and others as armed transports, and all, we believe, will carry torpedo boats. The steamers selected are the *Umbria*, *Etruria*, and *Oregon*, of the Cunard Line; the *America*, of the National Line; the *Alaska* and *Arizona*, of the Guion Line; the *Massilia* and *Valetta*, of the Peninsular and Oriental Line; the *Kaikoura*, of the New Zealand Steamship Company; the *Lusitania*, of the Orient Line; the *Mexican* and *Moor*, of the Union Line; the *Pembroke Castle*, of the Castle Mail Packets Line; the *India*, of the British India Steamship Company; and the *Nord-America*, late the *Stirling Castle*, recently belonging to an Italian owner at Genoa. The dimensions and tonnage of these ships are all well known to the shipping community, but not their speed, which varies much. For long distance steaming, the speed of the *Umbria* and *Etruria* is 18½ knots, of the *Oregon*, *America* and *Nord-America* 18 knots, of the *Alaska* 17½ knots, of the *Arizona* 16 knots, of the *Massilia*, *Valetta* and *Glenogle*, 15⅝ knots, of the *Kaikoura* and *Lusitania*, *Coptic* and *Britannia* 15 knots, of the *Moor* 14 knots, of the *Mexican* and *Pembroke Castle* 13½ knots, and of the *India* 13 knots. All these ships have a far better coal carrying capacity than any cruiser in the Navy, and which is one of the most important qualities after speed in a cruiser-catcher. Not only is the fuel endurance of these mercantile steamers sufficient to enable them to steam round the world at 12½ knots without re-coaling, but by using all available space for this purpose, even the 18 and 18½ knot ships can run at full speed for about three weeks on the coal they can carry. The importance of this cannot be over-estimated, when it is known that with the exception of the Brazilian ironclad *Riachuelo*, which is also a cruiser, no such man-of-war capable of being propelled at 16 knots and upwards can steam at this rate for more than a week without replenishing her bunkers. The *America*, *Oregon*, *Umbria*, *Arizona*, and *Nord-America* are being armed as cruisers and transports, but guns have not yet been fixed on them. The four first are being fitted at Liverpool, and the last at Malta. It is doubtful what the Admiralty propose doing with the *Etruria* and *Alaska*. The *Massilia*, *Kaikoura*, *Lusitania*, and *Coptic*, will probably be armed on the Australian station, the *Valetta* and *India* on the East Indian station, and the *Mexican* and *Moor* at the Cape. There are several very quick steamers of our mercantile marine which have not been secured for improvised cruisers and transports, but if war breaks out with Russia, about thirty-five more will probably be taken up. With the use of these auxiliaries it is to be hoped that we will be able to protect our commerce from the Russian sea wolves, and particularly as she will not probably be able to obtain the services of the faster of the North German Lloyds' liners, or *La Normandie*, of the General Transatlantic Company, which are the quickest foreign merchantmen afloat.

During the last and a great part of the present century the British Navy was fully efficient to protect our island from invasion and her commerce on the sea from hostile foes; but for the last fifty years or so, consequent upon the prodigious increase of our carrying trade and ships, which have given us the supremacy of the seas, and also on account of the population of this country being dependent upon two-thirds of their provisions from abroad, the Navy has been grossly inadequate, and is particularly so at the present time, to give us the extended protection we require. No doubt all Admiralty administrations have been to blame more or less for this inefficiency, which is due to an injudicious policy of minimising the naval expenditure to the lowest ebb. It is much to be regretted, therefore, that not until about nine months ago has any commendable zealous means been adopted by the press and platform to raise an intense public feeling and popular outcry in support of an immediate improvement in our naval defence. So great a danger is now, however, threatened to our commerce, Indian possessions, colonies, and coaling stations, if a war breaks out with Russia or any other maritime Power, that the appeal, though at the eleventh hour, has been productive of much good, by compelling the Government to lose no time and spare no reasonable cost in making the Navy as efficacious as possible within the shortest time. Nothing is more significant of the unanimous feeling which exists among all classes of intelligent persons for an adequate Navy, than the result of the large meeting of city men at Cannon-street Hotel on the 16th ultimo, to hear the expressions of opinion of leading members of Parliament on the wretched condition of our Navy, and the danger and injury which is likely to result to our commerce, people, and national prestige if we should be engaged in maritime warfare before our Navy is materially reformed. This meeting was entirely of a non-political character, and all present agreed with the strong and many sensational remarks made by the Lord Mayor, Mr. W. H. Smith, Mr. W. H. Forster, Admiral Sir John Hay, Sir Edward Reed, Mr. McCullagh Torrens, and others, and unani-

mously expressed approval of the resolutions proposed and strongly advocated for the improvement of the Navy in having more and better ships, guns, and men, and for the co-operation of all classes in any scheme of expenditure for this purpose. It is now a well-known fact that in proportion to the interests we have to protect, our Navy is far inferior to that of France, while Mr. Cobden rightly stated it should be double as powerful. Not only have we insufficient and badly armoured ironclads and cruisers, but both are mostly provided with obsolete guns instead of new long-ranged rifled steel breech-loaders of great penetrative power; while the latter class of ships are, with three or four exceptions, of insufficient speed, and all of defective coal-carrying capacity; so that if we were now at war with Russia our commerce would be almost without protection from the naval and improvised cruisers of that Power, if we had not secured the services of several fast merchant steamers as auxiliaries for this purpose. Even our Channel and Mediterranean Squadrons do not respectively number seven first-class ships, nor can such be provided; and consequently there would be none for reserve. The former squadron—which was sent to Ireland to display bunting on the occasion of the visit of the Prince and Princess of Wales—had, according to Sir John Hay, shown itself incapable of steaming across the narrow channel, and the *Minotaur* was only propelled at 9½ knots, so as not to distance all the other ships. The flag-ship of the Mediterranean Squadron, in sailing from Alexandria to Malta, broke down, and had, in an ignominious condition, to be towed into the latter port. No less than £7,000,000 of the £10,000,000 voted for expenditure upon new ships since the present Admiralty Administration took office, is lying in unfinished men-of-war in the Government dockyards, and which amount, Sir Edward Reed states, would, if we went to war with a maritime Power, be of no good to this country for the next six or twelve months—a state of things which is entirely owing to the fact that the Government have been engaged twice as long as they should have been in their construction, considering that both ironclads and protected cruisers can be completed in private yards in half the time as they can in Government yards. We quite agree with Sir Edward Reed, therefore, that we require both greater celerity and an improved expenditure in the production of war ships. Our lack of torpedo ships and torpedo boats is one of the greatest grievances we have to complain about in connection with our Navy. We are worse provided with these than France, Russia, Germany, and we believe Italy; and it is essential to purchase many of those now completed abroad, if possible, without delay.

The statement of Sir Thomas Brassey, in October last, that no amount of naval construction in time of peace would prevent the transfer of our carrying trade, or a large portion of such, to a neutral flag, if war broke out between Great Britain and a maritime Power, is greatly dreaded, and was much commented upon at the City meeting. It is feared that if the Navy cannot sufficiently protect our mercantile marine terrible sufferings, famine, and revolution would be likely to occur shortly afterwards, whereby we should be compelled to submit to the terms of the enemy, which would be fatal to the commercial supremacy, power, and position of this country. When such fearful consequences are expected from the supposition that provisions shipped under neutral flags to British ports would be condemned as contraband of war, all efforts should be made without delay, regardless of cost, to avert so shuddering and widespread a calamity, which involves the very existence of a vast multitude of our people and our future national welfare.

THE SAFETY OF ATLANTIC STEAMERS.

THE accident which befell the White Star steamer *Germanic* in the early days of April, was, happily, not one of serious importance, although it was bad enough in the opinion of her officers—coupled with the high and dangerous sea which was then running—to warrant them in turning back to Queenstown.

But, however trifling its consequences, the gale, and the sea which it threw up, appears to have been somewhat exceptional, and the ship was assuredly in great danger of more serious damage. To have had two heavy steam winches torn up from their fastenings, and some of her iron bulkheads, or houses, rent asunder by falling water, point unmistakably to high seas and heavy weather.

Her experiences should be accepted as a warning by all who have anything to do with the fitting out of ships; and by those builders, particularly, who have neither time nor inclination to take a trip across the Atlantic, in vessels of their own design and construction. There are shipbuilders and naval architects in this country, of much experience in ship construction, and said to be eminent men in their profession, who would refuse to believe, that a well secured steam winch could be torn up by a sea. There are even some who cannot understand that a big ship, like the *Germanic*, would ever ship a sea in such quantities as to break a pane of glass. Perhaps such persons are not numerous, but, unfortunately for the pockets of underwriters and the welfare of others, they exist more or less.

Since the foundering of the ill-fated *London* in the Bay of Biscay, we have been paying more and more attention to our upper works, and have been taught by a hard and expensive schoolmaster, that the nation which lengthens and deepens its ships, rises its responsibilities.

The *Germanic* is one of the fastest and finest of the great Atlantic liners; and has probably made as many as one hundred and sixty trips across the western ocean, without bringing herself within the special notice of newspaper correspondents.

She was built at Belfast by the celebrated firm of Harland & Wolff, in 1875, and is, in consequence, just about ten years' old. Not quite out of her first youth. The unusual amount of interest taken in her accident is due to two causes. First, as everybody knows, the Government is chartering and armouring many ships of her class, and of very much her model and lines. These ships are to carry the imperial colours at their peaks, and, what is of much more importance, imperial troops on their capacious decks. Armed with rifled cannon of far-reaching range, they are, in the capacity of troop-ships, intended to fight a running battle with the first enterprising enemy who feels disposed to try

conclusions with them, either in penetrating gun force or in speed. But when a man carries a great number of eggs in his basket, whatever may be his combative qualities, he is wise to recognise the force of that old maxim, that prudence, for him, is the better part of valour. Secondly, the *Germanic*, along with the *America* and other modern "greyhounds" charterted by the Admiralty, represents a type of ship which came upon the scene fully fourteen years ago, and which the celebrated White Star Line, and their builders in Belfast, introduced under the suspicions of many fairly good judges of what a ship ought to be like. Weather-beaten sailors, who had passed their long lives battling against the big seas of the western ocean; and who went *readily*, if not comfortably and regularly, to sleep every night down in the dark shadows of great watery caverns; shook their heads ominously at the appearance of the first "Atlantic greyhound." She was too sharp and lean! She was going to bury herself in a sea-way! Would be a coffin for all hands! and various other dismal predictions were quickly manufactured for such ships, "which had nothing to hold them up."

If such reasonable fears were not uttered by skilfully trained architects and constructors, their minds were thoroughly imbued with them, and with other dangers they "knew not of."

It was, perhaps, Sir William Fairbairn, an experienced engineer in iron fabrics, who predicted their "breaking in two" when crossing the crest of a sea. Sir Edward Reed had also the same suspicions. Results proved, however, that, like many other things, ships of the *Greyhound* class required trial, before reliable conclusions could be arrived at. They have now been running, as observed above, for some fourteen years, and are as far above suspicion as was Cæsar's wife. Naturally, when the *Germanic's* accident appeared in every newspaper in the kingdom, in large type; in the minds of some the old fears and suspicions returned, and possibly with some not ill-founded reason.

But the experiences of such ships during fourteen long years of trial have been so fortunate, and have impressed the minds of men so thoroughly with their general safety, that there is no more chance of us going back to the frigate model, than there is of turning the iron horse into a mail coach. We may, however, remember that these long and fine lined ships have one or two little drawbacks, which they would be as well clear of, and which is also an element of danger constantly besetting them, during storms. This disagreeable feature did not exist, or was certainly not sufficiently pronounced in the steamers of the frigate school. Such ships as the Cunard Line successfully weathered all the great Atlantic storms during a period of thirty years. When the head seas run high, and from the various causes of resistance on this account, and from consequent racing of engines, the ship's headway is deadened, these modern and fine-lined vessels will not keep up to the sea. They are constantly falling off.

In some cases, as happened a few winters ago, when the engines were—wisely or not—driven at full speed, it was found impossible to keep them "to." This, assuredly, is a great drawback to that reliant feeling which we all had at one time in our first-class ships, and an enduring source of anxiety to their officers. Whether the *Germanic* fell off too far in the undoubtedly heavy sea of Sunday morning, 5th of April, is not stated in her report; but, as during some nine or ten years of her career in this service she has never before had such an accident, and must have experienced frequently weather equally bad, there is some ground to suppose that such was the case. However, if it were so, it is not an insurmountable difficulty, and the resources of civilisation are already equal to the occasion. In the pages of a contemporary the matter was argued out some time ago; and although nothing very definite was arrived at, there was strong evidence in favour of the new method of "heaving to by the stern," as it was called, when the ship refused to keep her head up to the sea. It is a little unfortunate that some of the commanders of the ships in question, have not endeavoured to solve this problem for themselves before dire necessity, in the shape of yawning black chasms, and great foaming crests of water, kill their passengers with fright, and seriously imperil their vessels. When iron bulkheads twenty feet above the sea give way, and when steam winches are torn up by the roots, it is then too late to commence carrying out experiments whose failure, by the slightest hitch, would mean death to seven hundred human souls, and destruction to half a million of property. And all this at one great blow, and in an instant of time.

To ensure the success of this experiment, which would be like a harbour of refuge for the ship; all that is necessary is to try it during a fair wind and following sea, by stopping the engines and allowing the ship to take up that position which has been called "her natural one." She *will* take up some position, natural and friendly to her model and trim, and one assuredly, which her commander should be acquainted with. To carry out such an experiment successfully, it should be tried before the sea becomes dangerously high; and not harm, but good will be the result, if attended with the ordinary caution and practice of seamen. The most dangerous seas which run in the Atlantic are those which are thrown up by a long succession of winds from one quarter. Such, possibly, were those which this ship encountered.

Fortunately, it not often happens that the wind blows steadily from one point for any great length of time; not, at least, with great fury. Respecting this method of heaving the ship to, with her stern to the sea, there has lately appeared in the pages of the *Nautical Magazine* a most instructive letter from Captain Laub, of the Danish steamer *Thingvalla*, bound to the westward across the Atlantic. On the morning of December 5th, 1884, in lat. 56 N., and long. 28 W., during a heavy storm, the weather, at length, indicated the approach of a hurricane. Captain Laub, considering it dangerous to force his ship—probably deep laden—against the fury of the tempest, determined, very wisely, in stopping her engines, "and letting her drift." In his own words, "the steamer at once fell off and took her position, with the wind one or two points abaft the beam, drifting five points to leeward at the rate of two miles an hour, rolling easily and leaving a considerable wake to windward." Unfortunately for the success of this grand experiment, Captain Laub used considerable quantities of oil—as much as seven gallons of rape—and there is just a suspicion that, independent of his own opinion to the contrary, his wonderful immunity from heavy seas was due in great measure to the oil.

A large steamer of great draught drifting, as the *Thingvalla* did, dead to leeward, would leave a considerable wake to windward, independent of the effects of oil; but whether that would be sufficient to break the force of the seas, in such a remarkable way as is reported, is not easy to decide. Such a wake, given a vessel broadside on, does assuredly break the seas to some extent; and the *Thingvalla's* experience is not, in this respect, uncommon. Coming back to the *Germanic*, it will be seen, in her case, that she had a pretty rough handling; and the idea will naturally force itself to the mind, that this vessel had a possibly narrow escape. What, for example, may be expected to happen to iron constructions, and the innumerable houses which such vessels carry on their main decks; when those on the upper decks, even still higher from the water, are forced in by heavy seas? What, also, may not occur to large and low-lying hatchways, presenting broad and flat surfaces—when the ship rolls to windward—to the bursting force of heavy seas; when steam winches, having skeleton frames, and numerous and massive deck bolts, are torn up by the roots?

If, respecting the number of steamers which founder and are posted as missing every year, there is one thing more certain than another, it is, that such calamities come upon fully 50 per cent. by the ignorance and carelessness shown by their designers and builders, in the construction and security of their upper works!

Even in the construction of these splendid vessels, and the opinions and forebodings expressed by practical seamen and scientific engineers; the former, as results proved, in a great measure, were nearer the mark. The seamen said they would bury themselves, going head to sea; the latter predicted the giving way in the middle—breaking in two. The builders said they would bear filling with lead, and hanging up by the middle. They said nothing about or against plunging bows under; but as they were entirely open about the bows, it was taken to mean that they had miscalculated their possible behaviour, and, when put on trial, such was the case. They shipped such quantities of water, literally burying themselves forward, that it was found impossible to drive them; and an extra iron covering, called a "whale back," was put over the forecastle. Even when this was completed, and submitted to a practical test, science was again at fault. It was discovered to be too weak, and had to be strengthened. The fact is, connected with ships and their movements in heavy seas and gales of wind, scientific calculations are not reliable; not even when the seas of the Atlantic can be measured to an inch in altitude, and to a pound in bursting force!

Do our shipbuilders know how high these seas run, and how fast? Are they aware how long the wind has ever been known to blow from one particular point in mid-Atlantic? Have they made any calculations respecting the difference in effect upon a large steamer of 500 ft. length; of high waves running regularly from one point of the compass; and others, also high and dangerous, running from two or more points? Mr. Froude, and his successors at Torquay, may be able to establish many useful laws touching the safety of floating

bodies; and to give us much valuable information regarding the stability of ships. They may even succeed in measuring every wave and wavelet of the Atlantic, with numerous details of force, height, and direction; and, after all that, will still fail to make science, in this direction, superior to practice, and experience.

However, in various ways in which the rule of thumb has had not a little to say, these splendid fabrics of steel and iron are at last approaching as near perfection, as human eyes can at present distinguish. It rests for the architect to turn them out perfect, and for the seaman to guide them as much by a cool, clear judgment, as by any other refined and elaborate process of calculation. If there is still one fault to be found, it is, possibly, in design, more than in another direction; but, if it be a fault, it is a very serious one. It is supposed that when the *London* foundered, she took the seas down the engine-room skylight, whose top was knocked in. Our builders were not slow to make a note of this, and to cover such openings in with six or seven feet of iron housing. That was a move in the right direction; but how about the five or six great hatchways, which are still to be found in many, nearly all, ships; not more than eighteen inches above the deck? There are numerous reports coming in every winter of hatchways being knocked in. All this time, we have still been putting our ships down. They keep on going lower and lower, till at last there must be a move made in the direction of hatch coamings. A ship of 500 feet length should not have less than 60 inches, and a covering to stand a force of 20 tons' weight of water. Reducing this allowance at the rate of twelve inches, and five tons respectively, to every hundred feet, we come to 24 inches for the coamings, and five tons for the covering, in a ship of 200 feet length. There has been no public report of the amount of water the *Germanic* had about her decks, but anybody may easily guess that it must have been great and overpowering.

Her hatches would be under water all the time; and with steam winches flying about, it is hardly likely that anybody could have secured them if they had given way. There is no reason either, why they should not have given way, as readily as the iron bulkhead, or the winches.

THE FUTURE OF NAVAL WARFARE.

An Abstract of a Lecture, by H. Middleton.

WHILE we all readily admit that in the most perfect of our reasoning processes (to wit, the mathematical methods) the certainty of our conclusions depends on the truth of our premises; yet when we come to subjects connected with politics we are too prone to forget that a like certainty in the logical validity of our arguments can only be attained when our *statistics* (which correspond to the premises, hypotheses, or definitions in symbolic methods) are either true or *approximate* truths.

Parties in politics exist chiefly in consequence of the distortion of facts which politicians who cite the same, either through ignorance or design, practice with almost as little scruple nowadays as they did when learning was the privilege of a very few. For they know that almost as many will be found now to support them from ideas of interest in the fraud, as ever in times past when ignorance might have been the excuse.

As perhaps it may occur to some that I am uttering uncalled-for serious charges against those whose occupation is to play the part of rulers (or to try and play that part), I reply the remarks I have made are made not because I want to say disagreeable things or distasteful truths, but because I want to utter a protest against the doctrine which too many hold, that in most matters no arguments are valid and no conclusions unassailable, and point to politics for proof of the wide divergence in conclusions that are arrived at by some truly estimable men. Of course, I admit that this is sometimes the case; but *generally*, I maintain, if we could only take away the incentive to fraud we should soon see many a subject which seems shrouded in doubt, owes the same less to its intrinsic difficulties than to the distortion of those premises from which one or other political trickster manipulates so as to derive at will the conclusion he would *manufacture*.

Now there are few subjects under discussion at present which have suffered more from wilful complications and perversion of fact, than that of the existing conditions, objects, needs, and necessities of the Navy; hence I hope you will pardon me if I preface my remarks on the *future* of naval warfare by touching briefly upon the principles according to which, and the methods by which, operations at sea are at present conducted, and then we shall be in better position to understand the Navy's present condition and to see what developments are foreshadowed in *the future*. Indeed, time shall be devoted to trying to give answers to the three following questions, to wit:—

1st.—What *is the use* of a navy at all?

2nd.—What are the duties of a navy?

3rd.—What is the best method by which, and the ships with which, a navy can perform its assigned functions?

The answer to the first question is:—

The navy is maintained to enable us to pursue the only known method of insuring the safe conduct and continuance of trade between England and her colonies *in time of war*, or with those Foreign powers with which she may continue at peace. Furthermore, such *continuance* of traffic has now become *absolutely necessary*, because the population of these British Isles is dependant on foreign or imported corn *for bread*. So much so, that I believe it is hardly exaggerating to say that two-thirds of the people are in a more or less direct manner supported by external trade; and this trade cannot continue in time of war, *unless* England maintains her sovereignty over the seas. Indeed, we may say that the money spent on the maintenance of a navy should be regarded as a sort of insurance paid to protect the 19,000 merchant vessels which bear the British flag over every sea on the globe. And, further, we must remember that the capture or destruction of these merchant ships would occasion *unheard-of financial trouble*, even though a foreign war lasted for so short a time that the provisions (which might have been placed here in anticipation of the same) held out until "peace at *any price*" was paid for. And this is my answer to the query, "What is the use of a navy at all?"

I have tried to point out why a powerful navy was necessary in time of war; but lest there be some who ask, "What is the necessity for war at all?" or query why we cannot live in peace with every nation, it behoves me to say a few words in reply to such as think as I have hypothesized, before I turn to giving an answer to the second query I have proposed to myself at the beginning of this discourse.

A short time ago Mr. Kummer (the Chief of the Swiss Federal Bureau of Statistics) took the trouble to calculate what the population of certain European countries would amount to by the year 2,000—no distant date—provided (or under the supposition) the people now inhabiting them continued to increase at the *same rate* they are now doing.

According, then, to the Swiss statistician, the population of Great Britain and Ireland would reach 145,489,697, that of Germany, 164,678,076, while France could not expect to have more than 64,189,400 people at the rate they are increasing now. "Well!" perhaps you say, "but what have these numbers to do with naval warfare? And, further, are they not wanting even in general interest, from the fact that it is well known the countries named could not support such an increase of population?" I answer, it is *just because* these countries cannot feed so many additional millions, *therefore* these figures are *intensely* interesting; for it is upon, and with them, that we propose to cast the political horoscope of the future.

The scramble for the globe has already begun. Just at present* the interest centres upon Africa. No doubt the scene will, ere long, shift to the corn producing areas of the wide plains of the "Pampas" in South America; but, as it is with the immediate future we are concerned, the grain fields of Africa are the coveted prize, concerning the possession of which we may expect to find trouble at an early date.

Almost all the Great Powers of the earth are interested in finding places to which their ever-increasing and overflowing populations can emigrate to. I said "almost all the Great Powers," &c., for one of them, and that the greatest of all—I speak of this widespread English Empire—I say, England *alone seems utterly without a foreign policy*.

Do you *not now* comprehend the meaning of the figures I have quoted? Do you not see that they are the very "handwriting on the wall," predicting danger to existing States? Do you not understand that Germany *must expand*, and that such expanding is *most dangerous* to the preservation of the integrity of the British Empire in the future? Can you not see that, to check the power of Germany's growing greatness, we must not allow her overflowing populations to become colonizers under the German

* This was written January 2nd, 1885.

flag? Yet, so far from striving to prevent the increase of *German strength*, we are acting in such a manner as to *arrest the growth* of our own. We are permitting thousands upon thousands of our fellow countrymen to transfer their allegiance to the United States; and thus, year by year, the increase of our population reinforces not our own military might, but adds to that of those whose interests and aims are utterly antagonistic to Great Britain.

* * *

Want of time forces me to leave so interesting a theme, and to turn to answering my second question, to wit—"What are the duties of a navy?"

The to me unknown author of that *admirable* series of articles, which have lately appeared in the *Pall Mall Gazette*, so succinctly expresses this, that I hope he will permit me to quote his account of the threefold duties of the fleet, to wit: "They have (1) to protect England against invasion; (2) to keep open the ocean roads by which England is fed; and (3) to defend a vast empire over the sea."* But, as the writer from whom I have quoted does not appear to me to bring out prominently enough the Herculean nature of these tasks, perhaps you will pardon me for delaying a few moments while I try to make the same manifest.

It is said† that no less than 7,500,000 tons of corn are annually imported into the United Kingdom. Now, what think you is the magnitude of the merchant fleet requisite to bring this great amount of grain to our shores? Take 3,000 tons as the corn carrying capacity of a ship; then 7,500,000 tons represent 2,500 shiploads. Suppose the average length of a voyage (out and home) was 20 days, then *one such* ship could not bring the amount of corn which is annually consumed in less than 139 *years*. Or we would require 139 ships of 3,000 tons each (making voyages as hypothesized) during one whole year to supply the same. Or—to put the matter in a slightly different way—every 20 days from England's nearest corn producing base, to wit, Canada, a vast fleet of 139 steamers must set sail for the British coast; and it is these ships that the ironclad fleet are expected to "convoy" in safety to their destination. If *they fail* to do so, you *must starve*.

This is not the place that I propose to discuss methods of attack in naval war; still, perhaps, I shall not be anticipating my subject too much if I say *incidentally* in this connection the veriest landsman among you may get an idea of the difficulties attending such convoy, if he pictures to himself such a wild and stormy night at sea as comes to the fate of almost every ship to encounter during one of the eight or nine days that it takes to cross the North Atlantic. This is the opportunity which the enemy's cruisers have watched and waited for as unwearedly and patiently they have followed the convoyed fleet just out of gun shot of the protecting ironclads. At last their opportunity has arrived, and down come these ocean wolves on their ill-protected prey.

The ironclads are pitching heavily and helplessly. Confusion is made worse confounded as the wild fire from the misdirected guns of the men-of-war shrouds with the smoke of battle the doomed fleet. In and out do the torpedo launches ply, bearing destruction and death to ship and crew, while explosion after explosion, as it rends the storm tossed wind and waves, sings, too, the knell of a whole ship's company.

* * * * * *

It is not for the officers and sailors of the Royal Navy of Great Britain to declare in the public prints their dread of the result of such an action, but I doubt not there are few of them who have

"—— seen the horrid front of war,"

but would be *all but appalled* at the prospect of facing such dangers. No doubt it seems very fine for

"Ye Gentlemen of England
Who live at home in ease"

to tell us (in indifferent verse)

"Theirs not to make reply,
Theirs not to reason why,
Theirs but to do and die, &c."

but yet the sailor as well as the soldier *has a prejudice* against *being slaughtered*. No doubt it's *very unreasonable*; but, after all, man *is an unreasoning* animal.

* * * * * *

But the importation of corn is not the only duty of our merchant fleet in time of war. Another of vast importance is the exportation of coal. However, time is flying fast, and I must not speak of this and kindred matters, but instead turn my attention to my third and last question, to wit:—"What is the best method by which, and the ships with which, a navy can perform its assigned functions?"

Before we attempt to solve a problem, we should study its conditions, and to point out these requires that I should treat—though, of course, only with *great* brevity, and necessarily, therefore, *very imperfectly*, of those *general principles* of naval warfare which govern the design and construction of all ships of war whatever. For, it is on the knowledge of these principles that the utility of all inventions and innovations from established forms, designs, or models in matters of shipbuilding, entirely depend; and this is my excuse for obtruding upon you the following remarks.

In consequence of the application of steam to ships, together with the fact that the coal supply of an ironclad is so small that it can rarely steam more than four or five days without refilling its bunkers; while to supply the same usually two unarmed and unarmoured vessels have to accompany the fighting ships. I say, in consequence of these conditions, a new department of study has lately been added to the consideration of the operations of fleets on the high seas; and this department of thought so closely corresponds to what is known as "strategy," when we consider the movements of land armies, that we may, in like manner, now speak of naval strategy. For the defence and maintenance of communication with coaling stations is to fleets of as great an importance nowadays as the preservation of its "base" to an army operating on land. Indeed, the commandant of a fleet now operating on the high seas would be in greater danger than a general, who hopes to secure victory while manœuvring an army, both of whose wings are unsupported and the distance to whose base is extremely great.

As to the "tactics" of naval warfare with *steam* fleets, they can hardly be said to be yet written; and probably, until we have had ironclad fleets *repeatedly* in action, little or nothing can be known on this subject. This though can be most positively asserted—to wit, that with the navy *in its present* condition, Great Britain has no ships to waste *while experimenting* on the new naval tactics rendered necessary by the changed conditions of naval warfare.

You must *entirely divest* yourselves of the idea that because such and such was the relative superiority of the English navy to that of Foreign Powers—say 100, or even only 50 years ago—*therefore* the same relative superiority *exists now*. *Nothing is further from the truth.*

"In 1779 we had 293 ships of the line, 258 frigates, and 537 smaller vessels of war, while France had but 87 ships of the line and 60 frigates." Now, such is the condition of the navy, that an Admiral of the Fleet writes: "I consider it inferior to the French alone, in number, structure, and armament."

(To be concluded in our next.)

THE CUNARD STEAMER ETRURIA.

THE steamship *Etruria*, the latest addition to the Cunard Line, arrived in Liverpool Harbour on March 26th, from the Clyde, after an experimental cruise round the west coast of Ireland. She was, of course, light, with nothing but a full supply of coal on board; her screw showed 15 in. above the water; and her draught was 3½ ft. less than her water line. Notwithstanding these disadvantages, her steadiness and speed formed a subject of common remark among the experts on board. She left the Cloch light in the Clyde at 10 o'clock on Tuesday morning, March 24th, and crossed the bar in the Mersey about 8 a.m. on Thursday, March 26th. This showed a journey of 805 knots in 46 hours, with the steam at three-quarters. From the Fastnets to Ballycotton light she steamed at the rate of 19·6 knots per hour, with 63 revolutions of the screw per minute. On a six hours' run in the Clyde with Scotch coal she reached 67·5 revolutions of the screw and made 20·233 knots, going and returning between the Pladda and Sanda. This gives a speed of 24 statute miles per hour. She has not been tried on the measured mile owing to a storm having arisen on the day set apart for that purpose, but the continuous steaming trial is held to be more conclusive. The weather during the cruise round Ireland was sufficiently heavy to test the stability of the vessel. A strong north-west wind blew throughout Tuesday, and during Tuesday night the Atlantic waves came broadside on the ship. Steaming

* *Pall Mall Gazette* (Extra), No. 12. † *Pall Mall Gazette*.

westward the waves had no effect upon her; she passed clean through them without lifting; but a broadside attack naturally caused her to roll in her light condition; her oscillation, however, was perfectly smooth and was unaccompanied by tremor or shock.

The *Etruria* is a sister ship of the *Umbria*, both built by John Elder & Co. of Fairfield, Govan, the largest, most finished, and fastest vessels in the Atlantic service. She is built entirely of steel, and is divided into 10 water-tight compartments. She is 520 ft. long by 57 ft. 3 in. broad, and 41 ft. deep.

We give below particulars of nine of the largest vessels, all constructed within the last eight years:—

Name.	Builder.	Length.		Breadth.		Depth.	
		ft.	in.	ft.	in.	ft.	in.
Arizona	Elder	452	2	45	4	35	7
Alaska	Elder	500		50		38	
Servia	Thomson	515		52	1	37	
City of Rome ..	Barrow	560	2	52	3	37	
Oregon	Elder	500		54		39	9
Aurania	Thomson	470		57	2	37	2
America	Thomson	441	8	51	2	36	
Umbria	Elder	520		57	3	41	
Etruria	Elder	520		57	3	41	

Captain M'Meekin, who has been in charge of the *Oregon* during the last season from May until January, states that during the seven voyages she never steamed less than 400 knots per day coming east, nor did she vary more than four hours in the trip. Her quickest passage out and home, which is, indeed, the quickest passage on record—was done in 12 days 21 hours and 9 minutes, or an average of 18½ knots or 21·40 statute miles per hour. This is the record that has to be beaten; and it is not expected that it can be beaten except by the *Umbria* and the *Etruria*. The Cunard Company have now reached the limit of draught permitted by the entrance to New York. Measures, however, are being taken to dredge away or rather disperse the bar to the extent of 2 ft., by a machine called a dredging plough, which is designed to disturb the bar and disperse the sand by air force when the currents are setting seawards. Still, when this is done, it will only permit vessels coming east to be fully laden instead of as at present leaving freight unshipped. The shipowner and shipbuilder can now do little more for the ease of an Atlantic voyage; they wait upon the harbour and dock authorities for permission to increase the breadth and depth, and therefore the steadiness and comfort, of their steamers.

The *Etruria* is fitted to accommodate 720 first-class passengers. Several of the state rooms are fitted *en suite* for family use, and every advantage has been taken of the breadth of the vessel to afford variety and greater space in the accommodation. The saloon will seat 280 people at dinner, and as the electric lamps are fixed high up near the ceiling by slender pendants, the view is unobstructed throughout the chamber. The panelling of the saloon is all in light wainscot oak, with a dark walnut sideboard at the service end and a bookcase at the other. Above, in the form of a sort of gallery, is a music room. And on the same upper deck are a number of superior state rooms in the middle of the ship. Above these, and running for 300 ft. in length throughout the entire breadth of the ship, is a promenade deck. Here is the captain's room and a large saloon, exclusively set apart for ladies, sumptuously upholstered in green velvet and panelled in maple. Below, on the main deck, on a level with the saloon, is a boudoir, which forms a vestibule to the baths and lavatories set apart exclusively for ladies. Altogether there are thirteen marble baths, fitted with steam and shower apparatus; and lavatory accommodation is dispersed throughout the ship. On the main lower decks are placed the major portion of the state rooms. Each of them is provided with a hot-water heating aparatus, an electric light, and a life-saving cork jacket for each berth. The smoking room, which is unusually large, is fitted with red leather benches and panelled in maple and oak. It is placed on the upper deck. The electric light is produced by four of Siemens' machines, each with its own three-cylinder engine. Three of them are sufficient to maintain the whole 850 lamps of the ship, so that one is always in reserve, and oil lamps are entirely dispensed with. The passages, the engine-room, and boiler-house, are lighted day and night, and some of the lights of the saloon are also maintained during the night.

The engines are marvels of construction, and unequalled, except by those of the *Umbria*, for strength, power, and simplicity. With good coal they are capable of indicating upwards of 14,000 H.P., with nine boilers, but the speed attained by the *Etruria* has been secured by some thousands H.P. less than the *maximum*. The boilers are fired by 72 of Fox's corrugated furnaces. They work at a pressure of 110 lb., which was maintained during the cruise with a total absence of smoke, even with inferior coal. The engines are of a type which the Fairfield Works have made common. Three inverted cylinders work a built crank-shaft below, by a 6-in. stroke. The centre high-pressure cylinder is 71 in. in diameter, and the two low-pressure cylinders are 105 in. in diameter. The perfection of the workmanship was shown by the fact that from the time the vessel left the Clyde until she anchored in the Mersey steam was never turned off, and the bearings were cool throughout.

The object of the directors in taking the vessel round Ireland at this season was to give her a crucial test before sending her across the Atlantic. The heavy weather favoured the object, and the vessel has been proved in all her parts fit for the service as she leaves the builders' hands.

The party on board consisted chiefly of representatives of the Admiralty, the Post Office, and the railway interest. Mr. John Burns, the chairman of the company, was supported by Mr. J. C. Burns and Mr. Williamson, his fellow directors; and among the company were Mr. Barnaby, C.B., Director of Naval Construction; Mr. Messon, R.N., Controller of the Packet Service of the Post Office; Lord Colville of Culross, the Marquis of Ailsa, Admiral Farquhar, Admiral Fellowes, C.B., Mr. Chaine, M.P., Sir James Ramsay, Mr. Edward Barington, Mr. Langton, Mr. Cardin, Mr. Dence, Mr. Houston Boswell, Mr. Henry F. Walter, Dr. Donald Macleod, Professor George Macleod, and Mr. Shaw Stewart.

LAUNCH OF A JAPANESE WARSHIP ON THE TYNE.

ON the afternoon of March 17th, a cruiser built by Sir William G. Armstrong, Mitchell & Co., being one of two begun less than twelve months ago to the order of the Japanese Government, was successfully launched from the shipbuilding yard of the company at Walker, in the presence of a large concourse of spectators. Among those present on the occasion were:—Prince Yamashino, Mr. Ohyama (Secretary to the Japanese Legation), Mr. O. Koshi (Secretary to the Consulate), Mrs. O. Koshi, Mr. Suyematsu, Mr. and Mrs. Park, Mr. J. Hayi, Senior Naval Constructor, and Mr. Z. Miyabara, Senior Engineer, under whose superintendence the hull and engines of the vessel have respectively been constructed, assisted by Mr. H. Seki, Mr. H. Maritorno, Mr. M. Asaoka, Mr. H. Murano, Mr. S. Katsume, and Mr. J. Fukushime. There were also present: H.R.H. the Duke of Genoa, and officers of the Italian ship *Giovanni Bausan*; Captain Moult and officers of the Chilian armourclad *Blanco Encalado*; Commander Brunn and Lieut. Foss, of the Danish Navy; Mr. Popper, Naval Architect, of the Austrian Navy; Mr. J. Ulens, Engineer, of the Austrian Navy; Captain Soliani, Italian Navy; Chevelier de Martino, Sir W. G. Armstrong, Lady Armstrong, Mr. and Mrs. C. Mitchell, Mr. H. F. Swan, Mr. and Mrs. W. H. White, Commander and Mrs. Grenfell, Major Jones, General Steward, Mr. R. S. White (manager Low Walker Shipyard), Mrs. R. S. White, Mr. Boolds (Surveyor of Lloyds), Mr. L. Mills (principal officer of the Board of Trade), and a number of other ladies and gentlemen.

At the bow of the vessel a temporary stage had been erected, and upon it Lady Armstrong and the principal members of the company assembled just before the launch. The chocks having been knocked out, the vessel began slowly to descend towards the river. Just as it began to move Lady Armstrong dashed a bottle of champagne against the side of the ship and named it the *Naniwa-Kan*. The huge vessel glided with increasing speed easily down the ways into the water, amidst hearty cheers. The operation of launching was carried through in this successful manner, which was an appropriate climax to the rapidity as well as the thoroughness of the construction of the ship.

The following is a description of this ship and the uncompleted sister vessel:—The *Naniwa-Kan* is the first of two powerfully protected cruisers which were begun at the Walker yard of Sir William Armstrong, Mitchell & Co., about ten or eleven months ago. They were designed by Mr. W. H. White, and are the swiftest and most heavily armed cruisers at present in existence. They are also the largest war vessels that have been

hitherto built by the firm. During the last few years considerable activity has been displayed by the Japanese Government in connection with the development of their naval forces and the extension of their mercantile marine, a close connection existing between the two; and the merchantmen having been built so that some of the finest of them could be used as armed transports in case of war. Messrs. Armstrong, Mitchell & Co. have had the honour of undertaking the most important of these mercantile auxiliaries, and besides they have supplied nearly all the new war ships. About a year ago the swift cruiser *Tsukushi-Kan*, which had been built on the Tyne, was purchased from the Chilian Government by the Japanese; and soon after that purchase the contract for the two larger cruisers above named was signed. These three cruisers, with their high speed and heavy armaments, will constitute very important additions to the naval strength of Japan, and enable that country to make its influence felt in any complications which may in future arise in the Eastern seas. As regards the distribution of the armament and their external appearance the two new cruisers will bear a considerable resemblance to the famous *Esmeralda*. In fact they may be briefly described as enlarged *Esmeraldas*, with substantial improvements in defence, structural arrangements, protection armaments, and speed, these improvements having become possible in consequence of the increase in size. In dimensions the new cruisers are almost identical with the *Iris* and *Mercury*, dispatch vessels of the Royal Navy, and the *Leander* class of partially protected cruisers. They are 300 ft. in length, 46 ft. in breadth, draw 18½ ft. of water, and are of about 3,600 tons displacement. They have twin screw engines, which are to develop 7,500 H.P. at least, and their estimated speed is from 18 to 18½ knots. The armament includes two 28-ton 26-centimetre guns, mounted on centre pivot automatic carriages as bow and stern chasers. These heavy guns are worked and loaded by means of hydraulic mechanism, which is an improvement on that fitted in the *Esmeralda*. On each broadside there are three 15-centimetre guns of five tons each, also on centre pivot automatic carriages of Elswick design, and along the broadsides there are also placed no less than ten 1-in. machine guns and two rapid-fire guns. There are two military masts, in the tops of which four of the improved Gatling guns made at Elswick will be mounted. All the guns, except those in the tops, are carried on the upper deck, and all of them have strong steel shields protecting the gun and crews from rifle and machine gun fire. Besides the gun armament, each vessel will have a complete armament of locomotive torpedoes, ejected from four stations, two on each broadside, situated at a small height above water. Her powers of offence are further assisted by the presence of a most powerful ram bow, formed of an immensely strong steel casting, which projects forward under water, and would deliver a terrific blow upon the under-water portion of any of the ships attacked. The powers of defence are also remarkably developed. Throughout the length, and covering the spaces occupied by machinery, boilers, magazines, and steering gear, there is a strong protective deck, the central portion of which rises a little above water, while the sides slope down to some depth under water. This deck is of steel, and has a thickness varying from two to three inches; the total weight of the material used in this protection amounting to something over 450 tons. The few openings in this deck are protected by strong armoured covers, or armoured gratings, and when the ship is ready for action, and these openings are closed, the chance of shell fire reaching the vitals of the ship is extremely small. In addition to the steel deck, the defence is assisted by means of minute cellular subdivisions of the space lying above the protective deck and below the main deck, which is about six feet above water. In these cellular subdivisions very large quantities of coal can be stowed, and when the coal is in the ship it will add greatly to the defence. Below the protective deck in the hold there are also very large coal bunkers, from which can be drawn the supply of coal necessary for working the ship for a considerable time when she is in action. Water-tight subdivision is also carried out very minutely in the hold space proper below the protective deck. There are two separate engine-rooms and two separate stokeholes. The magazines are all duplicated and formed into separate water-tight compartments, and there is a cellular double bottom running through a very large part of the length of the ship. This double bottom is fitted to be used for the stowage of water ballast, and in this manner the draft and trim of the ship can be controlled as she consumes her coals, or ammunition and stores, so that whenever she has to fight her protective deck can be brought into proper relation to the water-line. Moreover, the cellular bottom and the subdivision of the hold space will add greatly to the powers of the ship in resisting under-water attacks by ram or torpedoes, or in preventing any serious consequences should the outer skin be damaged by grounding or other accidents. One very notable feature in the vessels is the extremely rapid rate at which they have been built and their advanced state of completion at the time of launching. The openings in the funnel, hatches, and engine hatches have been so arranged that the machinery and boilers can be passed on into the vessels without disturbing the decks in the least, and consequently it has been possible to push on with the internal fittings of cabins, mess-rooms, store-rooms, &c., previously to the launch. The magazines, shell-rooms, gun supports, and armament fittings generally are also in an exceptionally forward state, and the interval between the launch and final completion of the ships will be proportionately shortened by the amount of work done while the vessel remains on the stocks. It may be questioned whether any war vessel of the size, and with the complicated fittings which are embodied in the design of the *Naniwa-Kan*, has been built in so short a time; and the reputation of Walker yard for rapid execution of work, which was won by such a performance as the building of the *Hooper* in one hundred working days, is well maintained by the feat which has been recently accomplished. In strong contrast to this rapid construction is the time that has been occupied in the Royal dockyards in building cruisers of similar dimensions, and of the same kind of deck protection, but with different armaments, known as the *Mersey* class. The first of these vessels was ordered more than two years ago, and is only just ready for launching; but it may be safely asserted that the Japanese cruisers are in a far more complete state than the *Mersey* will be in when launched, and that long before the *Mersey* will be ready for sea the Japanese cruisers will be on active service. Unless unforeseen difficulties arise it may be anticipated that the *Naniwa-Kan* will be steaming off from the Tyne and firing her guns within four or five months from the present time. The engines are being constructed by Messrs. R. & W. Hawthorn, to whom Sir William Armstrong & Co. have entrusted the engines of the *Esmeralda*, and most of the other warships which have been designed and built by them. The accommodation and fittings of the interior of the vessel are of an exceptionally good and finished character, and, besides having four powerful electric search lights carried in commanding positions at bow and stern, each of the cruisers will also have internal electric lighting of the more important hold spaces. In every particular these vessels will embody the latest improvements in armament and equipment, and although they have been so rapidly constructed, it is but right to state that, in quality of workmanship and material, they will bear comparison with any warships built in the Royal dockyards. The rapidity of progress has been made possible by careful pre-arrangement and excellent organisation, as well as by the fact that the whole of the work is under the control of a single firm. A numerous and capable staff of Japanese constructors and engineers have supervised the progress of the work, which has been facilitated by their able and intelligent assistance in the arrangement of all the important features of both ships, armaments, and engines.

LAUNCH OF THE MERSEY.

On March 31st the first of a new class of "protected corvettes," intended to act as swift cruisers, was successfully launched from the Royal Dockyard at Chatham. The ceremonial part of the function was performed by Lady Key, who was accompanied by Admiral Sir A. Cooper Key. Among others present were Vice-Admiral Brandreth (Controller of the Navy), Rear-Admiral Watson (Admiral Superintendent of the Dockyard), Mr. E. C. Warren (Chief Constructor at Chatham), Mr. Salmon (secretary to the Admiral Superintendent), Mr. Palmer, and many of the permanent staff, besides a numerous company of military and naval officers and ladies, whose presence gave a bright gala character to the scene in the shed. The slip is a large one, but it seemed none too big for the hull of the *Mersey*. While, under the quiet and experienced directions of Mr. Warren, the preparations for the launch were completed, visitors had time to admire the fine lines of the ship's modelling, presenting a clean run fore and aft, and to note that the keel was cut away, as the shipwrights describe it, both aft and forward, so that she may the more quickly turn on her heel in rapid manœuvring. All being in readiness for the launch, prayers were offered by the Rev. W.

Dearden, Chaplain of the Dockyard, and then Lady Key, pressing a lever, released the rope holding the last of the dogshores, and in a few seconds the great ship began to move, and, sliding easily down the steeply-sloping ways, took the water buoyantly and floated up stream on the tide.

Designed as an armed cruiser for service in which her usefulness and her own safety upon occasion will depend upon her speed and ability to manœuvre rapidly, the *Mersey* is fitted rather for attack than defence. Although she might not be able to do much mischief to a first-class ironclad, her armament, including two 8-in. and ten 6-in. breechloading guns, torpedoes, and ram, would make her a formidable opponent for any unarmoured ship. The guns will be disposed so as to give the power of firing with the greatest possible effect while manœuvring. The two large guns are to be pivoted, one on the forecastle and one on the poop. On either side fore and aft of midships are two projections or sponsons, and in each of these one of the 6-in. guns is to be placed, the others, three on a side, between the sponsons, increasing the effectiveness of her broadside fire. Long ports in the forward sponsons permit the guns to be trained 4 deg. across the bow and to an angle of 60 deg. abaft, giving a lateral range of 154 deg., while they may also be fired with a depression of 7 deg., or at an elevation of 20 deg. The after sponsons admit of an equal range of fire. These guns carry their own shields for the protection of the gunners. She is also to carry one 9-pounder and one 7-pounder boat and field gun, a 1-in. Nordenfeldt and two ·45-in. Gardner guns. Whitehead torpedoes will be carried, and provision is made for discharging them either above or below water on each broadside. Except for the steel-faced armour, 9 in. thick, protecting the conning tower and the steel protective deck-plating, 2 in. thick where it is horizontal and 3 in. where it slopes downward across the coal compartments at the sides, the *Mersey* is unarmoured. The authorised complement of coal is 500 tons. Her engines, of the horizontal compound pattern, are to be of 6,000 I.H.P. She is provided with twin-screw propellers, and it is anticipated that her speed will be 18 to 19 knots an hour. The principal dimensions of the ship are—Length between perpendiculars, 300 ft.; extreme breadth, 46 ft.; mean draught of water, 17 ft. 9in.; load draught amidships, 19 ft.; load displacement, 3,600 tons. Her crew will number 300 officers and men. In the adjoining shed is another of the sisterhood—the *Severn*, now so far advanced that it is expected she will be ready to leave the ways in about three months.

ON THE EFFICIENCY OF MARINE BOILERS.*

By J. T. Milton, Esq., Memb. I.N.A.

(*Concluded from page* 14.)

If the system of forced draught be introduced, it appears from what I have endeavoured to sketch out, that even with the present ratio of heating surface to the coal consumption, greater evaporative efficiency will be obtained, and therefore the final temperature of gases will probably be lower; but still greater efficiency will then be possible by further increasing the extent of the heating surfaces. This will probably be best effected by decreasing the diameter of tubes in proportion to their length, and also by increasing either their number or length.

When the draught has to be obtained by the heat of the gases in the funnel, the ratio of length to diameter of tubes has to be limited, owing to the necessity of not offering too great a resistance to the passage of the gases, and this has led to the general practice of making the diameter of tubes not less than $\frac{1}{25}$th of their length. If, however, forced draught be used, there is no limitation of this kind imposed, and smaller tubes can be used with advantage.

For instance, in a given boiler capacity, taking $3\frac{1}{4}$ in. tubes as a standard, and maintaining $1\frac{1}{4}$ in. spaces for cleaning purposes, as is usual in good practice, we find that with $2\frac{3}{4}$ in. tubes 10 per cent. extra, and with 2 in. tubes 20 per cent. extra surface is obtainable, while if the spaces were reduced to $1\frac{1}{8}$ in. with the $2\frac{3}{4}$ in. tubes, and 1 in. with the 2 in. tubes, which would probably be found to be equally efficient for cleaning when we consider the reduced size of the tubes, these figures are increased to 18 per cent., and 43 per cent. respectively.

* *Read at the Twenty-sixth Session of the Institution of Naval Architects.*

I now come to the third part of the subject, viz., the continued endurance of the boilers.

In my judgment experience has shown us pretty clearly what will and what will not endure the action of the fire under usual conditions, the present boiler, in this respect, being the result of a large amount of experience and of the law of the survival of the fittest. For instance, it is pretty evident that the only furnace likely to give satisfaction is a circular one exposing no rivetted seam to the fire, and allowing a small amount of expansion due to variation of temperature without undue straining, a flat-sided furnace with its necessary stays having repeatedly been shown to be altogether unsuitable.

Again we know that the present method of fixing the tubes, viz., by rolling them till their expansion puts them in a state of compression in the tube holes, although efficient when the tubes and tube plates are kept clean, will not keep the tubes tight when even a comparatively small amount of non-conducting scale is allowed to accumulate on the tube plates or about the tube ends, the ends of the tubes then becoming so overheated as to relieve the strain they are put to by being rolled; while in other boilers in which a less than usual amount of heating surface is interposed between the grates and the tube plates, or in which the tube plates themselves are exposed to the direct radiant heat from the fires, the same thing happens even when the tubes and plates are clean. It is therefore apparent that so far as tube fixing is concerned, we are about at the limit of successful endurance with our present practice. On this account it will probably be found that, if forced draught is to be successful with a very high rate of combustion, the boiler must be so designed that the temperature of the products of combustion will be reduced before they reach the tube ends. This will not be a difficult matter to accomplish. In other respects I believe the present type of boiler will require no modification so far as endurance is concerned.

We have been much indebted to the Admiralty for taking the lead in the matter of forced draught, and their experience has shown that the system is quite practicable; but so far I believe I am correct in saying that their experiences have been directed only towards the end they have in view, viz., by burning an excessive amount of coal to obtain excessive power out of a given amount of boiler for a short time, irrespective of the question of economy of coal. This is directly opposite to the direction in which I have attempted to show progress in economy is to be effected, but as the question of economical cruising is also an important one, it is probable that as some of the vessels fitted with forced draught appliances become brought forward for active service, experiments will be made on them at powers corresponding to, and lower than, those obtainable with natural draught, by working with all the boilers with forced draught, but with much reduced grate areas. If these experiments are carried out and the results made public, we shall all be greatly indebted to the Admiralty, as the results cannot fail to have a considerable influence upon the future progress of marine engineering.

Wilhelmshafen Dockyard.—The necessary funds have lately been voted by the German Reichstag for the planned additions to Wilhelmshafen Dockyard, which, when finished, will render this establishment one of the most complete. It is proposed to construct a hauling slip, with movable stage, for torpedo boats, as well as sheds for storing them in the boat harbour, so that the Jade yard will become an important torpedo boat station. Another addition, of a still more important nature, is a large floating dock, consisting of three sections. This dock will be capable of receiving the heaviest ironclads, and had become an urgent necessity, as the dry dock at Wilhelmshafen can be entered by them only at high water, a circumstance which might involve total loss of a damaged vessel. Plans have also been drawn up for an engine-repairing shed and joinery shop, for barracks supplying accommodation for 1,000 men, as well as for garrison and workmen's bathing establishments, and a workmen's hospital. The buildings are to be ready this year. The construction of the second harbour entrance has made such rapid progress, that it is expected to be opened in the autumn of 1886. The north mole is nearly completed, but extensive dredging operations will have to be carried on to obtain the required depth for the entrance, so as to admit even the heaviest ironclads at all stages of the tide. The portion of the Jade-Ems Canal, built by the German Admiralty, is also near completion, and is to be opened at the same time as the second harbour entrance.

ON THE APPLICATION OF MODERATE FORCED DRAUGHT TO THE FURNACES OF SMALL STEAM VESSELS, UPON MR. P. W. WILLANS' SYSTEM.*

By Mark H. Robinson, Associate I.N.A.

THE application of forced draught to the furnaces of marine boilers, other than those of torpedo boats, has lately attracted so much attention, and has evoked so strong a desire for further information, that even a small and limited addition to our knowledge of the subject, if only it be based upon actual experience, may not be without use. As a member of the firm (Willans & Robinson, of Thames Ditton) by whom Mr. Willans' invention has been applied, I am able to describe a system of forced draught which has, at least, the advantage of having been tried practically, and successfully, and for a sufficiently long time, and in a sufficiently large number of instances, to enable a sound judgment to be formed upon its merits. But, lest too much be hoped from this preamble, I hasten to say that the field which the system covers is, so far, but a limited one, and that in respect of the vital question of economy, though a rough judgment can be formed upon it with some confidence, there are no quantitative results which can claim to have been arrived at with scientific accuracy.

Among the questions which had to be dealt with at Thames Ditton was that of providing satisfactory condensing machinery for small steam yachts and other small craft, but more especially for yachts. Four years ago, when work there was commenced, the desire to use condensing engines in very small boats running in salt water was less general than it is now, when even the smallest steam cutter carried at the davits of a yacht is, or admittedly ought to be, fitted with some simple form of condenser. Nevertheless, the owners of the smaller classes of coast-going steam yachts, with non-condensing machinery, were alive to the advantages of condensing, and the question often arose—How to get the same power as before from an existing boiler deprived of its accustomed exhaust-draught in the funnel?

The size of yacht referred to is the small decked or partly decked steamer, whose engines indicate from 40 or 50 to 100 or 150 H.P., and it is, perhaps, necessary to point out that this size of vessel lay under special disabilities. Smaller boats—such as open launches—had, as a rule, at that time non-condensing engines, and the sharp blast of the exhaust enabled them to work *with small and light boilers.* Larger vessels, on the other hand, had lofty funnels, and in that way gained draught and kept down the size and weight of their boilers. The small yacht (as just defined) was barred, both by her size and by her owner's ideas of appearance and comfort, from using either a high funnel or that last resource of efficiency, a strong and noisy steam jet. She was thus condemned, if her owner elected to condense, to work with a more sluggish draught than any other vessel, and, in consequence, to carry a boiler of such disproportionate size and weight as made it hopeless to look for high results in speed.

The same trouble, it may be remarked in passing, did not apply to the conversion of still smaller boats to the condensing system. It was not difficult to design vertical boilers for them with small water space and of light weight, which, though unsuited for working with either a strong draught or with salt water constantly renewed, were well adapted for natural draught and for use with a surface condenser, and which were able to give nearly as much steam per unit of weight as the hard driven boilers they replaced. Could similar designs have been accepted as suitable in larger boats the difficulty would have vanished, but such general acceptance has not yet been given, and the return-tube boiler still maintains its reputation for all but the smallest classes of machinery.

The question how to increase the evaporative performance of these low-funnel return-tube boilers, admitted, it must be owned, of an obvious answer, namely, that forced draught must be applied to the moderate extent necessary to make up for the loss of the exhaust steam in the funnel. This was clear enough, but the real question was how to do it?

The air-tight or closed-in stoke-hole was not, as a rule, admissible in a yacht, in whose internal economy it would introduce, or would be supposed to introduce, too many changes for the taste of the majority of owners. Besides, the question had sometimes to be considered with reference to open or partly open boats.

* *Read at the Twenty-sixth Session of the Institution of Naval Architects.*

The use of a simple closed ash-pit, with air supplied under pressure, was still less desirable. With a greater pressure inside than outside the furnace door, no perfection of fitting would long prevent an escape of hot gases into the stoke-hole, a leak which could not fail to increase with age and use. Moreover, the injunction to first shut off the draught before opening the fire-door is one certain, sooner or later, to be forgotten, and then the opening of the fire-door is followed by an outrush of flame, to the serious personal danger of the stoker. Even a mechanical connection between the fire-door and the air-conduit, to close the latter when, or even before, the fire-door is opened, meets only half the difficulty at the best; it does nothing to prevent the constant leak of hot gases past the fire-door.

Desirable as it was, the satisfactory application of forced draught in such cases appeared to be nearly hopeless, until Mr. P. W. Willans, my partner, devised and patented the plan shown in Fig. 1. A casing or chamber—a kind of mask—a few inches

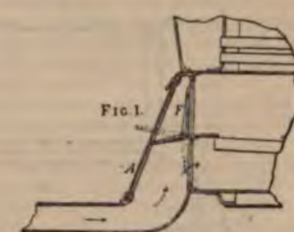


Fig. 1.

deep, is fixed to the boiler front over both the usual fire-door (hinged by preference at the bottom) and the opening into the ash-pit. The bottom of the casing is below the level of the stoke-hole floor, and is joined to a shoot which brings air from a fan. The front of the casing consists of a large door, which can be turned back or unshipped. When this is in place, the only exit for the air, after it enters the chamber, is through the ash-pit, the fire bars, and the funnel. The upper part of the casing is of course filled with air under pressure, and at a pressure slightly greater than that inside the furnace. Hence the leak past the fire-door is always in the right direction—*inwards*. The stoker cannot get at his fire-door for stoking without first removing the outer door, and the moment this is removed the boiler is working by natural draught, for the air from the shoot is as free to pass into the stoke-hole as into the ash-pit, and the pressure in the casing is destroyed without stopping the fan, or taking any other precaution. Danger to the stoker is at an end.

The casing or chamber is itself a small closed stoke-hole; so small that the man stokes through it from the other side. When forced draught is dispensed with, the outer door is taken away and the presence of the casing, or rather of its sides, offers no obstacle to stoking.

The first application of Mr. Willans' plan was in a small wooden coast-going yacht, the *Brenda*, of about 61 feet on the water-line, built by us in 1882. Displacement and draught were required to be small, for making trips to the Mediterranean through the French canals, and as high speed was also desired, it was necessary to restrict the size and weight of the boiler as much as possible. With this object Mr. Willans designed an oval return-tube boiler, 7 ft. long by 5 ft. wide by 6½ ft. high, stayed across. It had one furnace tube of 2 ft. 9 in. diameter, the fire-bars being about 4 ft. 3 in. long, giving a firegrate area of nearly 11 square feet. The total heating surface was 375 square feet, which was, of course, very large for the size of boiler—a fact accounted for by the large proportion of heating surface in the tubes—330 square feet, in comparison with the whole. This was obtained by using a great number of small tubes—148, of 1¾ in. diameter. The tubes were of brass, and about 5 feet long. The form of boiler was convenient, as giving good bunker room at the sides, and it saved weight in comparison with a cylindrical boiler, by somewhat restricting the water space. At the same time good provision was made for circulation. As might be expected, the large tube-surface extracted the heat from the gases most effectually, and the temperature in the uptake, though never tested with care, was low in comparison with that usual in small marine boilers. The working pressure was 120 lbs. The height of the funnel above the fire-bars was less than 11 feet.

With natural draught and careful firing, about 80-horse power was indicated. With a very light fan draught, not exceeding half an inch of water pressure, this power was approximately doubled. It was obvious that the boiler was in no way forced or

overdriven, and no question of leaky tubes arose. It was, in fact, evident that at least 200 horse-power might have been given by the boiler before the question of overdriving would have needed to be considered.

In comparing this boiler with others it must not be judged by its total heating surface, but rather by its capacity (which was roughly equal to that of a cylindrical boiler of 5 ft. 10 in. diameter) —or by its grate area, which was not purposely restricted, but was as large as was consistent with a good-sized combustion chamber beyond. On referring to the list of a well-known maker of small marine engines, I find that a cylindrical boiler of 6 feet diameter, by 7 ft. 6 in. long is represented as having 300 square feet of total heating surface. This is with 58 tubes of 2½ in. diameter, and there is no reason to suppose that this boiler (which is larger than the *Brenda's* boiler) would not be capable of doing at least as much work, if its tubes were as small and as numerous,

FIG. 2.

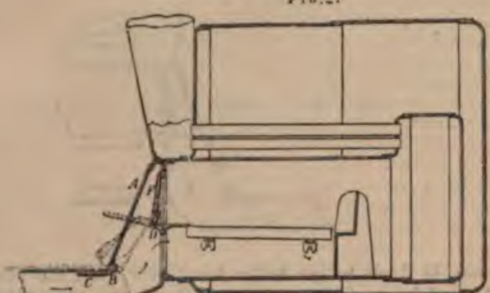
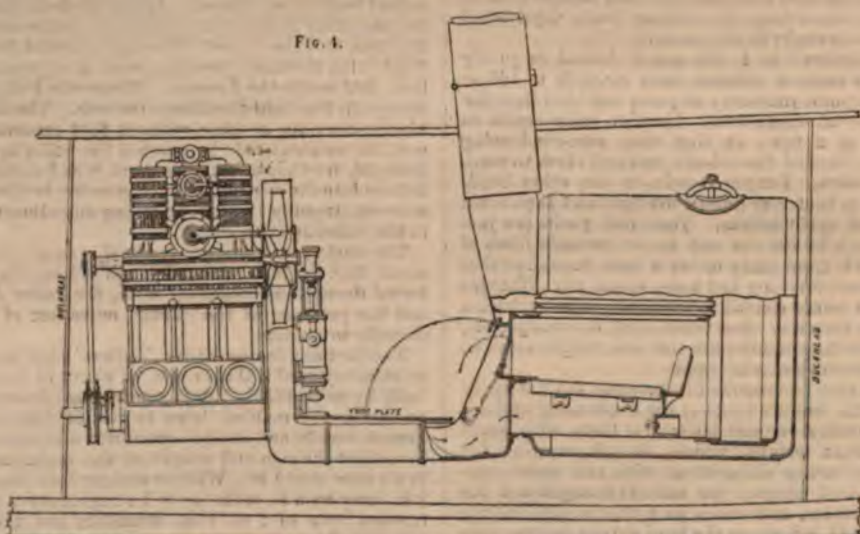


FIG. 3.

FIG. 4.



and if the draught were forced to the same degree. Tubed as described, and worked with natural draught (probably with a higher funnel), it is specified by the maker as suitable for a compound condensing engine of no more than 90 I.H.P. With little or no alteration, beyond an increase of tube surface, and the application of moderate forced draught, it seems probable, therefore, that its evaporative power might be *more than doubled*, and, as will appear presently, without loss of economy.

The engine of the *Brenda* was an ordinary Willans' patent compound surface-condensing engine, with low-pressure cylinders of 12¾ in. diameter. and 10 in. stroke, able to indicate 150 H.P. at 360 revolutions and 120 lbs. steam pressure. As economy in this vessel was deemed less important than light weight, a low ratio of expansion was adopted—under five to one, and the coal consumption, as ascertained by numerous trials, all somewhat rough, but reliable in the aggregate, lay between 2½ and 2¾ lbs. per I.H.P. per hour. This was when working at moderate powers—up to about 120 H.P. No reliable tests were made at higher powers, but the consumption did not appear to increase in any marked proportion. Nor was it likely to do so, because at the highest powers the sharpness of the draught was far below that used in many non-condensing vessels, such as the ordinary high-pressure Thames tugs, for instance. In the *Brenda* it need not be said that the forced draught was inaudible, and was in no way a nuisance on board.

The fan draught thus amply fulfilled its purpose of combining power with lightness, and the yacht achieved a high rate of speed as intended.

With regard to other matters it was found, first, that while the comfort of the engine-room was increased, as might be expected, by the ventilating effects of the fan, the labour of stoking, *and particularly the skill required in stoking*, were very much diminished.

In small return-tube boilers, working with a slack draught, it is necessary to keep a thin fire, and it need not be said that frequent attention and some skill are required to prevent a thin fire from burning through into holes. When the yacht was doing her best with natural draught (making rather over 10 knots), the fire-door required to be opened about once in twenty minutes. When doing the same speed (which chanced to be the ordinary working speed) under fan draught, the fire-door was opened in practice *only once an hour*. On one occasion the yacht ran from Teddington Lock to beyond North Woolwich—*over* 29 *miles*—without opening the fire-door, and was by no means without a fire at the end of the run. On another occasion she ran from Greenhithe to Westminster (22 miles) partly against tide, without opening the fire-door, and arrived, in exactly two hours, with a fairly good fire. The explanation lay in the fact that, with the strong draught, a very thick fire could be carried thick enough neither to need replenishing for a long time, nor to

be in danger of burning through into holes. However, for practical purposes, it was sufficient that stoking was brought to be but an hourly event, and that thechief difficulties of stoking a small return-tube boiler were removed. The system, as may be supposed, has always been liked by the engineers of the boats, whose reports have been uniformly favourable in the six yachts in which, up to the present time, the system has been applied and practically tested.

It is hardly necessary to say that with a locomotive boiler much longer runs might be made than those just recorded, because in a fire-box of locomotive type a very much deeper fire may be used than is possible in the contracted furnace flue of a return-tube boiler. It is possible that this fact may not be without influence upon the construction of marine boilers in future, when the advantage of a deeper fire than the ordinary return-tube boiler affords has been recognised. But in hazarding this opinion I have no intention of recommending the adoption, for general work at sea, of what is now known as the locomotive type boiler, the practical objections to which are thoroughly understood.

Secondly, at powers within the range of natural draught, and at which alone comparison was possible, it appeared that not only was there no loss of economy, but that a distinct though small gain resulted from using fan draught. The gain was sufficient to be noted in practice, as the result of repeated runs, but it was not established by direct experiment. It has, however, been confirmed by all our later experience with moderate forced draught. Its cause was no doubt the greater advantage to which the coal was burnt in a thick than in a thin fire, reduced chances of mischief from unskilful stoking, and the less frequent disturbance of the fuel in putting on fresh coal.

In the first apparatus fitted, it was found that when the two doors were open, and the fan running, the air from the shoot passed too close to the furnace door, and was apt to draw out from the furnace, and carry into the engine room, the light particles of ash lying near the opening. Mr. Willans therefore designed the form shown in Figs. 2, 3, and 4, in which the outer door A, which turns upon a spindle B at the bottom, and lies upon the floor of the stoke-hole when opened, has a prolongation C, which is raised against the top of the air-shoot while A is shut, but descends and closes the air-shoot, as A is opened. The spindle B carries a crank or lever, connected by a slotted link with another lever on the spindle D, which carries the fire-door F, in such a manner that F does not commence to open until C has closed the air-shoot (though with an easy fit), and has practically shut off the blast. This plan, which appears to work quite satisfactorily, has been applied in several cases, one being that of a steam fishing yacht of about 40 tons, the machinery of which, of 100 I.H.P., is shown in Fig. 4.

Another almost duplicate set of machinery has lately been sent to America, in the hope that the fan draught will enable anthracite coal to be burned in a boiler otherwise of English type, and a third set is ready for shipment to the same destination.

For the sake of simplicity the fan has hitherto been mounted upon and driven by the main engine. There are many advantages in using an auxiliary engine, but in small yachts one of the elements most to be considered is the possible inexperience, or even neglect, of the engineer, and driving by the main engine not only gives him an engine less to attend to, but makes it impossible for him to run the fan and raise steam improperly, while the engine is standing or is working at low power. It also ensures, in a rough way, through the varying speed of the engine, that the greater the power used the more air shall be supplied. In Fig. 4 it will be seen that the fan is mounted in a cast iron casing, which is combined with the forward main bearing of the engine. The shaft passes through the casing, and by a crank on its forward end works the air-pump and feed pumps. The air-pump is inverted, and is attached to the fan casing. In some examples only the lower part of the casing is of cast iron, the upper part being of thin iron or steel, for lightness. The fan casing does not stand vertically at the end of the engine but leans over to the port side, so that the spindle of the fan may be continued aft, past the back of the engine. At G is a pulley, by which it is driven from the larger pulley H, formed upon the main crank shaft coupling. Several methods of driving have been practised. Steel bands, running upon leather-faced pulleys, and with tightening pulleys for taking up the slack, have been used; so have pitch chains, and Gandy's cotton belting, sewn endless, has also worked well. That no kind of belt driving is always perfectly satisfactory on ship board, is unfortunately true, but the small liability to temporary failure which exists is the price paid for getting rid of a separate steam-engine. Even if a failure happens it cannot be said that in a yacht any very vital interest is jeopardised, while repair, if necessary, is not more than a question of minutes. In a vessel of larger size it would of course be better to use a separate engine.

It is worth noting that the ventilation given by the fan is so much valued that the owner of the last-mentioned yacht has had a door cut in the lower part of the fan casing, so that the fan may deliver air into the engine room when it is not required for the furnace. In this case it must be rather circulation of air, than the introduction of fresh air, which is effected, but its action seems to be found beneficial.

The removal of ashes from the ash-pit is easily effected by shipping a temporary bridge across the bottom of the chamber. Any ashes, &c., which may fall into the shoot are removed by taking up a well-fitted floor plate in the stoke-hole which forms a portion of the top of the shoot or conduit from the fan to the chamber. Absolute tightness in the shoot is unimportant, with such low air pressure.

It is unfortunate that, as stated in the beginning, there are no really accurate figures to be placed before the meeting.

It may be assumed that directly a steam yacht is ready, the owner wishes to take her away, and the opportunities given to the builders for carrying out anything like continuous and systematic trials are very few indeed.

But from the approximate figures and the general facts given it may be said with confidence that Mr. Willans' plan both meets an obvious want, and meets it successfully. The class of vessels to which it most directly applies, though numerous, is not, of course, an important one, from the point of view of the shipowner and shipbuilder, and its chief interest for them will lie in the inquiries, first, whether the system has any probable application in larger vessels, and, secondly, whether from the limited experience with it described in this paper, there result any suggestions towards the extended application of forced draught generally.

To the first inquiry, as a builder of small vessels only, I can offer no answer. That must come from the shipbuilder, the marine engineer, and the owner, who will know best whether the efficiency and comfort of the stoke-hole will be better promoted by enclosing it under more or less air-tight hatches, or by leaving it open and providing the furnaces with double doors upon Mr. Willans' plan.

The general suggestions to which our limited experience give rise are, I think, these:—

First, that systematic experiments should be made to ascertain the strongest draught under which coal can be burnt with advantage, *varying the construction of the boiler with the increasing draught.*

Secondly, that for the purpose of such experiments, and generally, it may be laid down that the variations necessary are three in number:—

(*a*) Provision should be made for working with thicker fires, as the draught is increased. The well-known facts of locomotive practice are alone sufficient to suggest the propriety of this.

(*b*) As the draught increases, so should the size of the combustion chamber, in order that combustion may be completed before the gases enter the tubes, the smallness of which is unfavourable to the continuance of combustion.

(*c*) With stronger draught there should be larger heating surface, obtained chiefly by reducing the size of the tubes and increasing their number.

The two last suggestions are also obvious enough, because both the space for completing the process of combustion, and the surface provided to absorb the heat produced, should clearly vary rather with the quantity of hot gases than with the size of the boiler or the area of the fire-grate.

As to the tubes, our progress has been steadily in the direction of smaller tubes. We are now using 1¼ in. brass tubes instead of 1¾ in. for lengths of about 4 ft., and should not hesitate to use them for greater lengths. Small yachts, no doubt, are expected to burn smokeless coal as a rule, but we have had some experience of 1¾ in. tubes with very smoky Scotch coal, and the small tubes in that case caused no inconvenience, though the boiler worked only by natural draught. The sharper the draught, the less, of course, is the tendency to foul.

In conclusion, it should be once more pointed out that the success achieved in the vessels fitted upon Mr. Willans' plans must not be looked for, as of course, in other and different vessels. Larger vessels begin where we, so far, have left off. Our object has been to raise artificially the rate of combustion in small vessels, to that hitherto obtained naturally in large vessels to raise still further the rate of combustion in large vessels is a different matter. But I venture to hope that it may eventually be treated successfully upon the lines just indicated.

THOMPSON'S APPARATUS FOR EXTINGUISHING FIRES AT SEA.

AMONG the many devices for extinguishing fire on board ship that have been brought under our notice, none appear to possess in so marked a degree the merits of simplicity, reliability, and cheapness, as the one now under notice.

The inventor, Captain W. H. Thompson, for some time commander of the *Britannic*, has fitted that vessel, and the *Germanic*, two of the most powerful vessels of the White Star Line, each of about 5,000 tons burden, with the apparatus, at a cost of considerably under £200 each vessel, a sum which we venture to predict would be passed, even in these hard times, without exception being taken to it. Captain Thompson's plan consists in combining steam and carbonic acid gas as a means of extinguishing fire, which is conveyed to the seat of the outbreak by means of the appliances shown in the accompanying illustrations, which will be noticed to be at once simple, safe, and efficient.

Fig. 1 is a sectional view of a vessel fitted with an arrangement for extinguishing fire by means of steam and gas combined. The steam pipe, brought from the principal boilers, or from the donkey boiler, is joined by a portable connecting pipe to one of a series of vertical pipes which lead to the main deck, 'tween decks, hold, or coal bunkers, by means of a quadrant plate.

Fig. 2 is an enlarged perspective view, showing the steam and portable connecting pipes, which latter may be made of flexible hose or copper, joined to the quadrant plate A.

Fig. 3 is a view of the apparatus in which the gas generator is fixed, between the steam pipe and the portable pipe. This generator, which may be constructed of iron, or of wood lined with pure lead, contains the necessary ingredients for making carbonic acid gas in a sufficient volume, when mixed with steam, to overcome any fire that may break out.

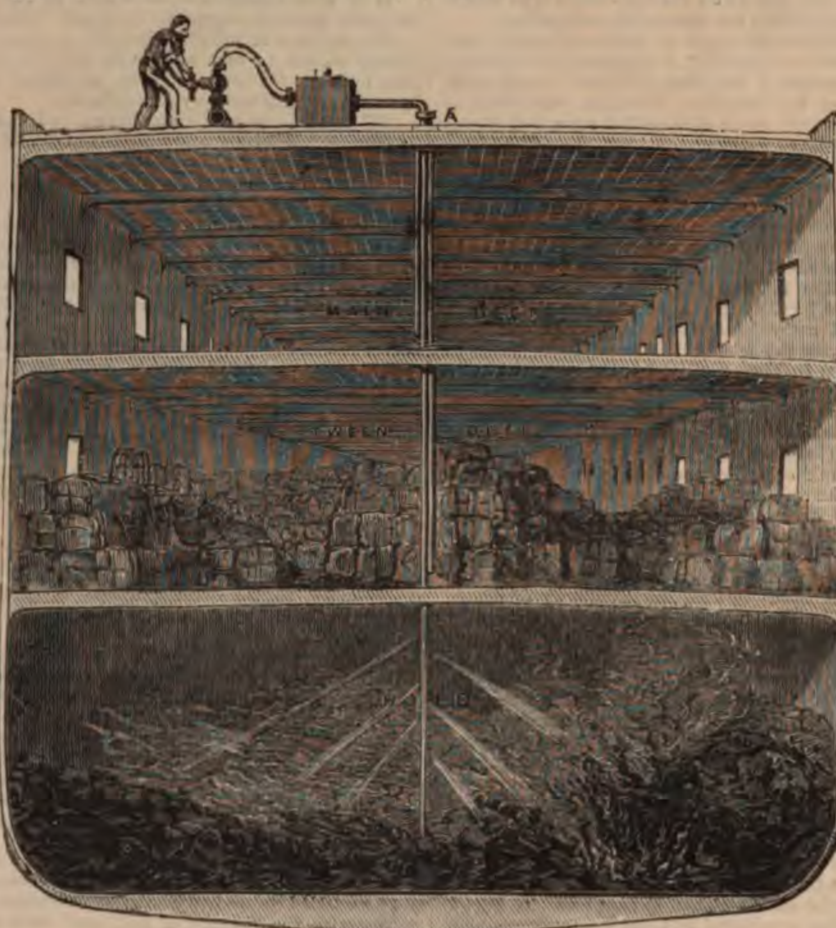


FIG. 1.

To extinguish a fire by steam only, all that is necessary is to connect the portable pipe to the descent pipe leading to the compartment in which the fire has broken out, and open the steam cock; but when the carbonic acid is to be used in combination with the steam, the gas is released by merely unscrewing a nut on the generator, the steam is turned on, and the combined steam and gas pass on to the outbreak. If preferred, the gas can be used alone. It is also proposed to provide the vessel with a fire detector, electrically connected with a dial in the captain's cabin, on which not only will the fact of fire be shown, but also the actual compartment in which it

occurs. Thus the captain can with scarcely any aid extinguish the fire, and this so noiselessly that during the night no alarm need be created, and the passengers remain unaware of the danger that has been averted.

By the aid of these combined arrangements the possibility of a fire obtaining the least hold is reduced to a minimum, and their simplicity leaves but little chance of their getting out of order, there being no valves to become leaky or to be opened by mistake, neither can there can be any condensation in the pipes, or other objectionable features to deal with.

The sole makers of the apparatus, Messrs. Merryweather & Sons, the well-known steam fire-engine makers, of Greenwich, will gladly supply any further information as to the capabilities and adaptation of the apparatus.

Fig. 2.

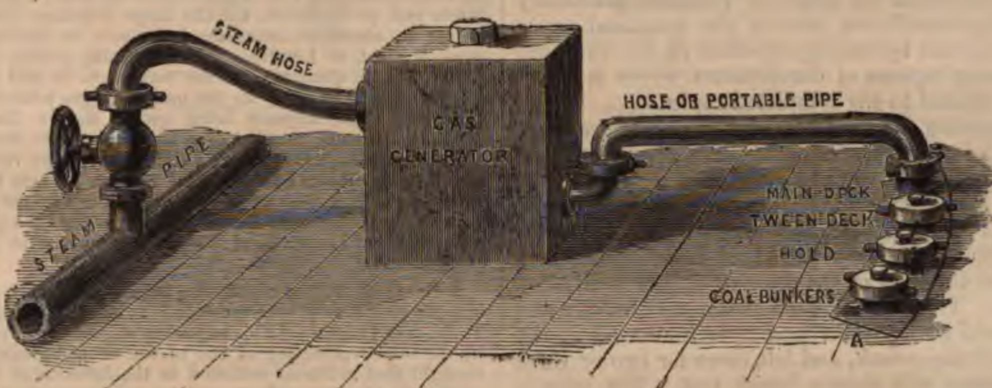


Fig. 3.

HELIOGRAPHIC DRAWINGS.

THE method of reproduction of mechanical drawings by the action of the sun upon sensitised paper, has already been largely adopted among the engineering and architectural professions. The saving of time effected by such a process is so great in the reproduction of copies of mechanical drawings, occupying a boy only a comparatively few minutes to finish that which would have required a couple of days' work by a skilled draughtsman, ensures a prompt adoption of such a system were the process sufficiently known.

The process, as introduced some time ago by Mr. J. R. Gotz, of 19, Buckingham Street, Strand, and now comparatively well known, produces copies in which the lines of the drawing appear as white lines upon blue ground, and is of the simplest kind. The copy and the heliographic paper are placed upon the glass of the copying frames, the original copy with its face downwards. The exposure made to bright daylight will in from 7 to 20 minutes produce a chemical change on the surface of the sensitised sheet except upon the parts underneath the black lines, and the white lines are developed upon the blue ground by immersion in a bath of clean water. Mr. Gotz has, however, now perfected an equally important improvement upon this, by which drawings are reproduced in blue lines upon a white ground, the so-called positive process. As the blue is very deep in shade, this produces drawings which from our personal inspection we can affirm to be equally as serviceable, equally as well finished, and equally as pleasing to the eye, as a drawing in black ink, produced by the ordinary draughtsman. The following is the process which has to

be employed for the production of this new heliographic drawing.

As in the previous process, white transparent tracing paper or cloth should be used for the original from which the copy has to be taken, and the lines on the tracing must be perfectly black, stains and blots being carefully avoided. Light blue lines, such as are sometimes used for dimensions should be avoided in the original, but bright red, yellow, or Sienna may be employed in the tracing. Dimensions are best shown in dotted lines, so as to mark the distinction in the copy produced between dimensions and outlines. The tracing should not be coloured, but the copies can be coloured after printing like any original drawing. After putting the original into the printing-frame, face downwards, place the sheet of heliographic paper upon it, the sensitive surface being in uniform contact, folds being carefully avoided, and a piece of felt or thick cloth covering both, to equalise the pressure. The exposure is made in full daylight as before. As in this process over-exposure is detrimental to the result, care must be taken to adjust the length of exposure to the brightness of the light, and the time of exposure will vary from one and a half or two minutes in bright sunshine to fifteen minutes in very dull weather. In practice there is no difficulty in determining the proper time of exposure from the appearance of the light. It is easy, however, to determine the length of exposure practically by introducing a small test piece of the sensitised paper into the frame, and by testing the effect of the exposure by the following process of development which is afterwards to be applied to the completed copies.

Before removing the finished print from the frame, it is desirable to turn up the edge of the paper for about half an inch all round, so as to make as it were a tray of the sheet, to prevent the solution getting on the back of the paper. The print is floated on the developing solution face downwards, for a period of from one to two minutes, until the lines of the drawing appear a distinct bluish green. The print is then taken up carefully and washed in cold water, whereupon it is immersed in the second—the fixing—bath, and left there for two or three minutes, where it will show a bluish tint. The print is then transferred to the trough of clean water, face upwards, and the unfixed part of the pigment is removed with a soft camel hair brush, the blue lines of the design being left on white ground. It is needless to say that no daylight must be allowed to fall upon the paper until after it has been developed, though the after processes may be carried out in the ordinary lighted room.

The resulting drawing, as we have said, is all that can be desired, and the process in operation is a great deal more easy than it would, perhaps, appear from such a foregoing lengthened description. The composition of the developer are given with the paper, or on application to the above address; the fixing bath consists of a solution of hydrochloric and sulphuric acid.

We have no doubt that these new drawings, with the blue lines on the white ground, will be greatly welcomed by the profession generally.

The *Times* states that the guns now preparing for the Royal Navy and the merchant cruisers include a large supply of the new 6-pounder quick-firing breechloading guns. These weapons resemble a light field gun in appearance, and fire a metal cartridge ten or twelve rounds a minute.

Miscellaneous.

The first steel steamship ever built in San Francisco was recently launched from the yard of the Union Ironworks. She is a screw vessel of 750 tons, and is intended for carrying coal.

The *Formidable*, a new ironclad, said to be the most powerful vessel of the kind in the French Navy, was lately launched at L'Orient, with complete success. The *Formidable* has been in course of construction for six years, and is a sister ship to the *Amiral Baudin*, which is still in the Brest Dockyard. She is 342 ft. long, 69 ft. beam, 49 ft. deep, and built of steel and iron. Her displacement is 11,336 tons, and her speed is to be 15 knots.

A New Gun Vessel.—We learn that designs have been prepared at Portsmouth of a new gun vessel, which will be built at a cost not exceeding a fourth that of the *Inflexible or Colossus*. She will carry one 120-ton gun forward, while astern she will be armed with six heavy breech-loaders of a calibre not less than those carried by ships of the *Dreadnought* type. She will be also armed with six machine guns, and will be pierced for six torpedo tubes. She will be capable of great speed, and though she is to be called a gun vessel she will in reality be a torpedo cruiser.

Quick Despatch.—We are informed that the River Tyne Dry Docks, Engineering, & Boiler Making Company, Limited, received on to their new pontoon on March 30th the *Olive*, s., of Sunderland, a vessel of about 2,000 tons deadweight. The steamer was docked at 5 p.m., then lifted, scraped, and cleaned, and after receiving two coats of paint, was undocked and towed away to her loading berth at 2·30 a.m. the following morning, thus occupying only 9½ hours for the whole work.

The Armed Cruisers.—The Admiralty have entrusted an order for twelve complete sets of gun traversing gear, together with the pivots and pivot plates, for the large merchant steamers which are to be converted into armed cruisers, to Messrs. Maudslay, Sons, & Field, of London, The traversing plates, or racers, are about 14 ft. in diameter, and are wanted to be laid down immediately so as to be ready for the gun carriages when they arrive at Liverpool. The urgency being great, Messrs. Maudslay have kept a considerable number of men at work upon the fittings continuously through the Easter holidays, with the result that four sets for the *America* and the same number of sets for the *Oregon* were despatched last week, and the other sets are to follow as soon as completed. As the beds have already been prepared, it is estimated that the whole of the fittings will be in place and the guns mounted this week.

A Board of Trade report has been published on the explosion of a Howard safety boiler, causing the death of one man. Mr. T. W. Trail says:—"This explosion appears to have been caused by the local overheating of one of the wrought iron tubes. It is thought that sediment collected in the interior of the tube, and prevented the water from getting into contact with the iron; consequently it got hot, which rendered it unfit to sustain the internal pressure, and the explosion occurred. Water-tube boilers have not been very favourably looked upon in this country, and when used the feed-water should be practically free from deposit; and there are comparatively few places where such water is available for feeding boilers. It is essential that the heating surfaces of all boilers be kept clear, but where tubes are used, and almost in the fire, unless great care be taken, deposit is sure to collect, and in this case, unfortunately, it has apparently caused the death of one man."

Mr. James Laing, shipbuilder, and chairman of the Sunderland Shipbuilders' Association, has written a letter to a public journal giving his views on the strike at present existing among certain operatives employed at shipyards. He says that Sunderland has obtained an unfortunate notoriety for strikes, and that the evil consequences are obvious to everyone except the workmen themselves, whose experience seldom extends beyond the narrow circle of their own comrades and sympathisers. With regard to the position and prospects of shipbuilding, he remarks: "An impression prevails that the tide has turned, and that more work exists on the river. I wish I could endorse the opinion as to the turn of the tide. There may be more tonnage in the several yards, but it will be found on inquiry that a larger percentage now exists than did a year ago of unsold ships. I myself hold 11,000 tons of unsold vessels, which were laid down for the purpose of providing work for my men during the winter. I shall only be too glad to find at the end of 1885 a better state of things than now exists I have, however, grave doubts thereof."

BREAKDOWNS AT SEA.

WE are exceedingly pleased to have received and to publish herewith sketches of two breakdowns at sea, with which we have been favoured by a correspondent. We feel sure that our readers will be equally gratified with the hints as to hasty repair given by these sketches, and we hope will be moved to emulation to afford us and our readers equal pleasure by similar accounts within their own experience.

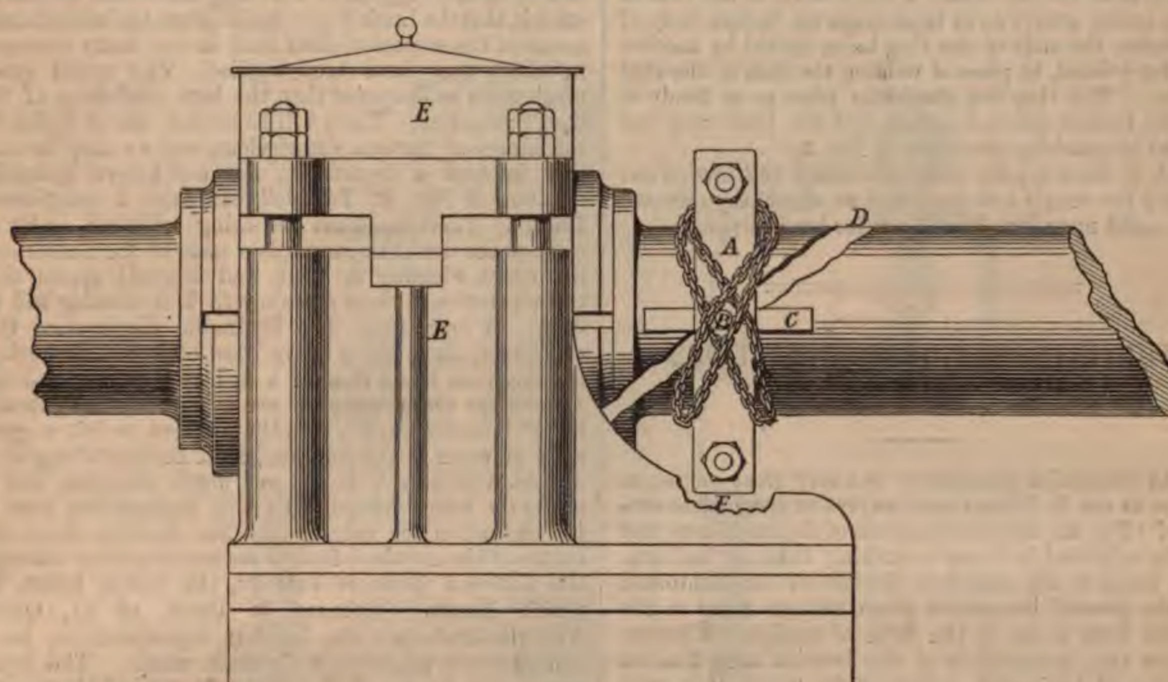


FIG. 1.

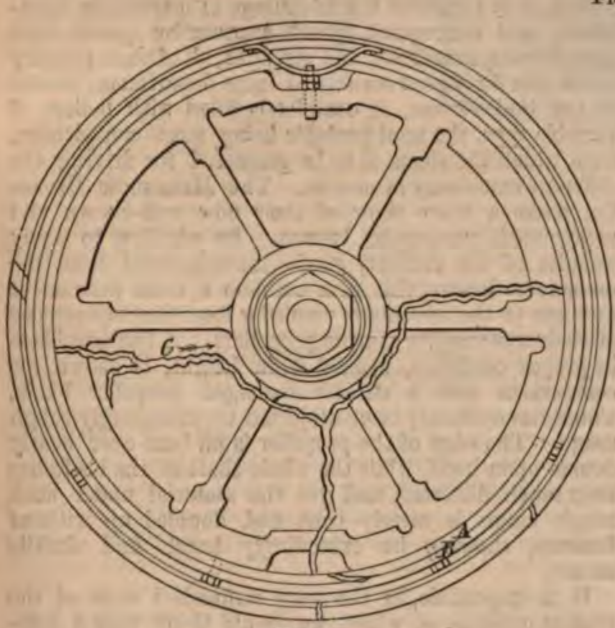


FIG. 2.

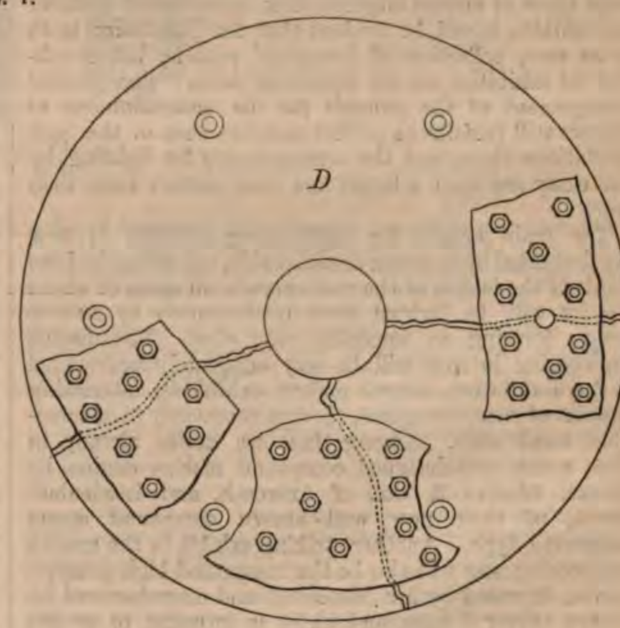


FIG. 3.

Fig. 1 shows a breakdown to the propeller shaft of s.s. *Dafila*, which occurred in rough weather in the North Sea. The chief engineer, Mr. C. Rindfleisch, undertook very ingeniously to repair the same with such material as he found to hand. He took a clamp A from the mast and securely bolted it around the fracture, which was fortunately diagonally across the shaft. Between the clamp and the broken shaft, he fitted a strong steel key C sunk ⅝ of an inch into the shaft and let into both broken ends, so as to unite them by the said key. The whole clamp was strengthened by a chain so as to prevent it springing

away, and a set screw B was tapped into the clamp to hold the key in place.

Fig. 2 shows a plan of a cracked piston with the junk ring removed. Fig. 3 shows an outside view of the broken junk ring. This belonged to the s.s. *Argus*, and was broken in the Bay of Biscay. Mr. C. J. Rindfleisch, who was also chief engineer in this second instance, took one side from an iron ladder A, and fitted it to the bottom of the spring groove so as to embrace the broken body of the piston, the ends of the ring being united by another piece lap-jointed, in place of welding the ends of the ring together. The ring was shrunk in place so as firmly to bind the broken piston together, and the junk ring was mended by patching as shown in Fig. 3.

Both of these repairs were sufficiently well carried out to bring the vessels into port, and we should say reflected great credit upon Mr. Rindfleisch for his ingenuity.

THE INTERNATIONAL INVENTIONS EXHIBITION.

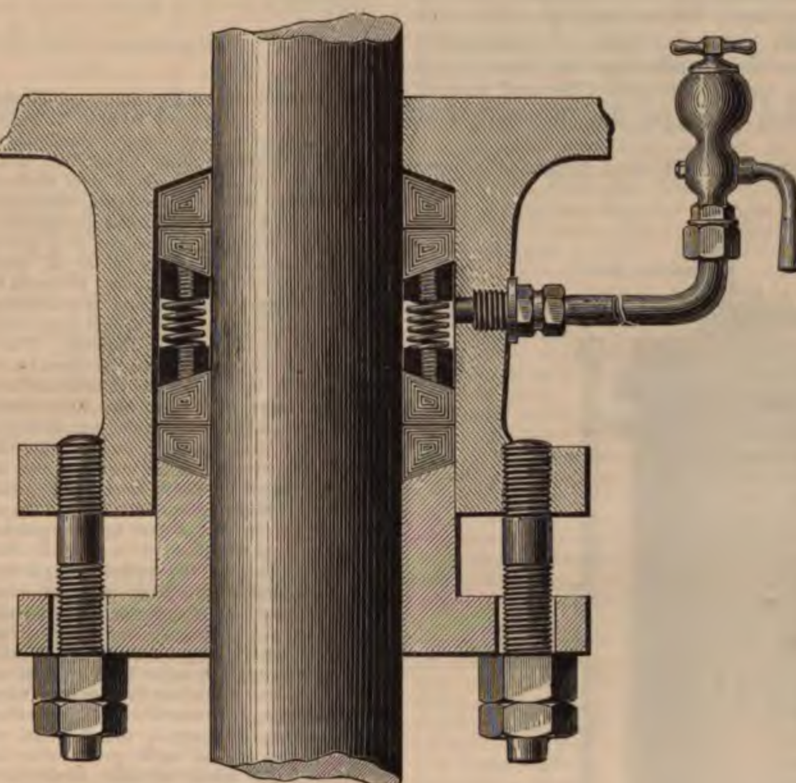
THIS Exhibition promises to be a very great success, as far as can be judged from its present incomplete condition. The size and completeness of the machinery that is to be exhibited is far more striking than we had supposed would be the case, from the title of the Exhibition and the general impression given that so many of the exhibits were to be in the form of models. When we mention that locomotives of the heaviest type, traction engines, and horizontal engines of 30 to 40 H.P., with small types of marine engines, form conspicuous items of the exhibits, it will be evident that the Exhibition is to be no mere collection of inventors' models, but a substantial exhibition on an industrial scale. The general arrangement of the grounds for the entertainment of visitors still remains as perfect as it has been in the past exhibitions there, and the arrangements for lighting by electricity are upon a larger and more perfect scale than ever.

The main arcade for engineering exhibits is now supplemented by an annex on either side, extending for two-thirds of the length of the main arcade, all three of which arcades will be lighted most picturesquely by electric lamps, forming an imposing *coup d'œil.* The marine engineering interest will be very adequately represented at the Exhibition, several makers exhibiting interesting samples of marine engines, though necessarily of a somewhat small scale. Among these we notice already in place a very well-designed compound marine engine, by Messrs. Shanks & Co., of Arbroath, and Leadenhall Street, of their now well-known compound steam hammered type. Another striking exhibit in the marine engineering way will also be the compound high-pressure engine, invented by Mr. Marchant, and manufactured by Messrs. Oliver & Sons, and which is intended to be the representative of the economical marine engine of the future. Mr. Marchant's name has been well known for many years as associated with a persevering effort on his part to design and carry out a combined engine and boiler which should form a complete cycle, the exhaust steam being returned by a system of pumps to the boiler. Much disappointment has attended Mr. Marchant's efforts in perfecting this arrangement, but we should be glad if his present exhibit at the Inventions Exhibition should be shown at work, so as practically to demonstrate his theory. The Fox patent Corrugated Flues, manufactured by the Leeds Forge, and now so largely adopted in marine boilers, form a conspicuous exhibit in the central arcade, and we should suggest, as a striking addendum to such an exhibit, that the Leeds Forge should present tabulated statements of the success of their flues in the many instances in which they have been applied. This would speak much more to the point than the bare exhibition of the flues themselves. There will be no lack also of hydraulic machinery of various descriptions, and we may be sure that in such a department the well-known hydraulic rivetters of Mr. R. Tweddell will form a conspicuous feature. These machines are being exhibited, as far as one can see from the incomplete state of the Exhibition, by Messrs. Fielding & Platt, and it would appear that the adaptation of these machines to keel riveting will be shown in operation. The Hydraulic Engineering Co., of Chester, make also a brave show of hydraulic work, a striking item being that of a hydraulic crane; and the Pulsometer Engineering Co. are conspicuous neighbours, the Pulsometer being evidently arranged to lift a great show of water. The fine compound horizontal engine of Messrs. Galloway & Co. is well worth attention, and is evidently being erected with the business-like view of its utilization for driving the line shafting down the centre of the arcade. Boilers are not forgotten amongst the different items of exhibits, the Cestus boiler, for which Messrs. Stevenson & Davis, of 11, Queen Victoria-street, are the London representatives, being conspicuously exhibited in the main arcade. This boiler promises to be one of the most successful of the present season, as it combines the advantage of marvellous circulation, and consequent great evaporative power, with compactness, simplicity, and strength, all of them primary necessities for a good boiler. A large department, known as the Boiler-house, is completely filled with boilers of variable type, the semi-portable being most conspicuous, from which the steam is to be generated for driving the different machinery in motion. The Manganese Bronze Co. make a brave show of their now well-known and appreciated manganese bronze. In addition to many samples of the ordinary goods manufactured from the manganese bronze, this firm exhibits a most instructive example of the advantage resulting from the employment of their material for marine propellers. A full size blade in proper condition, some 8 ft. in height, is shown for comparison with a similar damaged propeller blade, which has evidently been subjected to exceedingly rough usage. The edge of the propeller is all bent over nearly double upon itself, while the whole shaft of the blade has been much distorted, and yet the material under such rough usage is merely bent and doubled up without fracture, showing its exceedingly tough and ductile nature.

It is impossible, in the very unfinished state of the present exhibits, of which, we should think, only a comparatively small part will be completed for the opening on the 1st May, to say anything in detail of the exhibits beyond recording the excellent impression given to us consequent upon our inspection of the preparations for the Exhibition, which are now being so rapidly pushed forward.

DURHAM'S PATENT COMPENSATING OIL RINGS.

WE illustrate this arrangement, which is the invention of Mr. F. W. Durham, of New Barnet, of known velometer celebrity, and which is, we understand, being generally adopted, and is giving great satisfaction. The features are that it reduces the friction of rods to the lowest possible minimum; the packing being in reality a ring or bath of oil through which the rod works, and which is prevented from escaping by being held between two layers of any ordinary packing. These layers are kept tight to the rod, at either end of the box, by the pressure of a spring or springs upon two metal washers, as shown in the sketch above, the oil being introduced through the cup. The cost is very small, as when once fitted it will last as long as the engines, only requiring at long intervals the renewing of the packing; and which, through being always in direct contact, and saturated with the lubricant, has little or no wear, and never gets hard. It absolutely prevents scoring of rods, and perfectly lubricates them, keeping them cool, and entirely dispensing with "swabbing," or in any way externally lubricating the rods, and gives more revolutions of engines with the same consumption of fuel, through the removal of the brake power, which must necessarily be applied to secure a tight gland under any known plan; and the most important advantage of all, is the certainty of always having an absolutely steam-tight gland never requiring to be taken up by the gland nuts; when once fitted, the springs automatically compensate for the little wear which takes place in the packing. It is easily applied to any stuffing-boxes, which require no alteration whatever beyond the drilling of a ⅝-in. hole for the oil cup.



Rapid Engining of a Steamer.—It will be remembered that the steam whaler *Cornwallis*, Captain J. Nicoll, while on a voyage from Dundee to the Davis Straits whale fishing, had a serious breakdown in her machinery north of Peterhead, in consequence of which she had to be towed back to Dundee. The damage was found to be so extensive that it was decided by the owners that the engines should be replaced by new engines of greater power. A contract was entered into on 16th March with Messrs. Alexander Shanks & Son, Arbroath, to provide a pair of compound inverted cylinder marine engines of the ordinary type, having a high pressure cylinder 21 inches diameter, a low pressure cylinder 40 inches diameter, and a piston stroke of 2 feet. These engines, with 90lbs. steam pressure will develop 380 H.P. The engines had to be placed on board by the 7th May, which was considered a very short time in which to accomplish the work, but so systematically and expeditiously were the engines built that the makers despatched them to Dundee on 8th April, when they were placed on board the vessel and all connections made and the engines tried under steam on 13th April. The whole contract was thus completed within four weeks from the date of the order. It is needless to mention that the engines were actually built in that time, no part whatever having been in progress previous to the order. The extreme despatch with which the machinery has been provided and placed on board will thus enable the *Cornwallis* to be in time to take part in the whale fishing during the ensuing season, and it is gratifying to think that our Arbroath engineers are well able to hold their own in the marine engineering world.

FRESH WATER CONDENSERS.

PRODUCING fresh water from the sea being a matter of interest and importance to most of our readers, we here give an illustration of, with brief article bearing on, condensing apparatus as manufactured by Messrs. Franklin, Hocking & Co., Limited, Liverpool.

This type of condenser has been very largely adopted by the Admiralty and most of the leading steamship companies, also many land stations abroad where the natural supply of fresh water is scarce. To give some idea we may here state that condensers are now in use having a condensing power of over one and a half million gallons of fresh water per day of twenty-four hours.

The condenser is constructed of a series of copper

concentric tubes or chambers annularly arranged one within the other. The steam passing down inside the chambers becomes immediately condensed by the cold circulating or cooling water passing up alternately between each chamber. The condenser may be worked by natural circulation or pump. Each chamber is constructed of strong copper, having thoroughly tinned steam surfaces and perfectly smooth, so that no grit or dirt of any kind can lodge in the condenser. The ends are closed by brass rings driven between the two thicknesses of copper, and riveted through. These rings have bosses drilled and tapped, into which are screwed the brass steam tubes that convey the steam from above the division plate into the chamber. The bottom ends of the steam inlet tube have terminal ends with slotted sides, so that the steam on entering the condensing chambers is spread over all the surfaces. Each chamber is tested to 120 lb. the square inch before being put together, and when the condenser is complete it is subject to the same high pressure. The makers claim simplicity of construction, large cooling surface, equal distribution of circulating water, rapid condensation, great economy in space, lightness, general efficiency, and accessibility for testing by Board of Trade surveyor, &c.

Every condenser is fitted with the necessary filtering and aërating arrangements, so that the water is perfectly cold and fit for immediate use as it issues from the condenser.

Cast-Steel Stern Frames and Rudders.—At the Liverpool County Court, on March 20 and 21, an action by Messrs. Jessop and Co., steel manufacturers, Sheffield, to recover from Messrs. Cook & Milchreest, naval architects, of Liverpool, the balance of an account for making a cast-steel stern frame and rudder for a steamer built by the defendants, was heard; and on the 30th the Judge, Mr. Collier, delivered judgment. It appeared that the defendants were the patentees of a new stern frame and rudder made of cast-steel in the place of wrought-iron; and in the spring of 1882 the parties came to terms for the plaintiffs to make an experimental rudder and stern frame for exhibition, and a second one for a steamer which they were then having built by Mr. J. Smith, Old Quay, Preston. The terms arranged were at the rate of £35 per ton for the stern frame, and £33 per ton for the rudder; but a dispute afterwards arose as to whether these were inclusive of bushes and other extras or not. The stern frame and rudder were made, but through an accident in testing the rudder was broken; and as the builder was pressing for delivery the stern frame was sent on and fitted to the vessel, whilst a second rudder was being made. When the second rudder was sent on, however, it was found that it would not fit, and Mr. Smith stated that he was put to an expense of £17 odd in order to make them fit and work, the plaintiffs when called upon to make good the work having declined. For the plaintiffs it was contended that every precaution was taken to secure a fit, that the new rudder accurately fitted the model before leaving the works, and that the misfit was due to bad management at the shipyard in fitting up the stern frame and rivetting on the plates. For the defence, a number of witnesses were called to show that every care was taken at the yard on receipt of the stern frame, and that the misfit was due to faulty construction. His Honour, in delivering judgment, found that the original agreement between the parties as to prices was inclusive of extras. He attributed the misfit to some fault in the manufacture, but considered the claim of £17 for making it right excessive, allowing only one-half the amount claimed. Deducting the amounts so allowed, together with £16 3s. 3d. paid into Court, from the plaintiffs' claim, there remained a sum of £7 8s. 7d., for which he gave the plaintiffs judgment. He, however, refused an application to allow costs on the higher scale. Mr. Stewart, barrister, appeared for the plaintiffs, and Mr. Quiggin, solicitor, for the defendants.

George W. Bell, one of the fathers of the American merchant marine, died in Brooklyn last Friday. He was a member of the old shipbuilding firm of Webb & Bell, who constructed many merchantmen and war vessels. In later years they built several ships for the Pacific Mail Steamship Company. The gradual disappearance of American vessels from the seas was a source of much sorrow to Mr. Bell, and he often spoke of it to his old friends, and was continually consulting with them and trying to devise some plan for reviving the earlier glories of the maritime interests of this country. Once a year the old sailors and shipbuilders met at the Sailors' Snug Harbour and discussed memories of the past. The discovery of gold in California in 1849 gave a great impetus to shipbuilding. Under the spur of driving competition, the Americans built clippers that sailed from this port to San Francisco in 90 days. The American skippers were famous for carrying clouds of canvas in the heaviest weather, and superstitious foreigners did not dare to ship with Yankee captains. The famous *Flying Cloud* once made the run to San Francisco in 89 days—a record which no sailing vessel has since beaten. The *Dreadnought*, the *Great Republic*, and the *Young America* are about all that are now left of the old clipper fleet, and they are no longer manned by Yankee tars nor carry the stars and stripes.—*New York World*, March 22.

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of* THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—ED. M. E.]

LAUNCHES—ENGLISH.

Queen of England.—On March 30th there was launched from the shipbuilding yard of Messrs. Thomas Royden & Sons, Liverpool, a sailing ship, built to the order of Mr. Donald Kennedy, of Liverpool. This vessel has been constructed on the same lines as the *Celtic Monarch*, which was launched some time ago by Messrs. Royden for the same gentleman, her dimensions being:—Length, 277 ft. 3 in.; breadth, 42 ft. 5 in.; depth, 24 ft. 3 in.; and her gross tonnage is about 2,200 tons. On leaving the ways the vessel was christened *Queen of England* by Miss Kennedy, daughter of the owner. The *Queen of England* is specially intended for the Calcutta trade.

Georgia.—On March 30th there was launched by Messrs. W. Gray & Co., from their yard, an iron screw steamer of the following dimensions:—269 ft. by 36 ft. 6 in. by 19 ft. 5 in. moulded, to carry about 2,400 tons, and classed 100 A 1 at Lloyd's. The vessel is of the well-decked type, with poop aft, containing handsome saloon and cabins for officers and a few passengers, long raised quarter-deck, connected to bridge amidships, the latter being carried over the machinery space, coal-bunkers and main-hatch right up to the foremast, thus covering in the lowest part of the vessel, and adding greatly to her strength and stability. The crew are housed in the fore part of this extended bridge, which will add much to their comfort. The usual topgallant forecastle is fitted forward with Clarke, Chapman & Co.'s patent combination capstan windlass. She has four hatches, four steam winches, donkey-boiler, and water ballast in double bottom under each hold, and is in every respect well equipped for general trading. The engines, which are of 150 H.P., are being supplied by Messrs. Black, Hawthorn & Co., of Gateshead-on-Tyne. The christening ceremony was gracefully performed by Mrs. Stocks, wife of A. G. Stocks, Esq., Barrington House, Stockton-on-Tees, the vessel being named *Georgia*.

Bempton.—On March 31st Messrs. Edward Withy & Co., West Hartlepool, launched from their yard an iron screw steamer built for Williamson W. Lamplough, Esq., London. Her dimensions are 282 ft. by 36 ft. by 19 ft. 11 in., and has a deadweight carrying capacity of 2,500 tons. The vessel has a long quarter-deck with short poop, bridge-house, and top-gallant forecastle. The main, bridge, forecastle, and quarter decks, bulwarks, rails, skylights, chart and wheel house, &c., are of iron. The vessel is divided into six watertight compartments, and is fitted with water ballast on the McIntyre principle, Cochrane's donkey boiler, four horizontal steam winches by Clarke, Chapman & Co., Gateshead; Napier's steam capstan windlass and patent anchor crane on forecastle; and is rigged as a double topsail schooner with iron lower masts. The vessel has been built under Lloyds' special survey for the 100 A 1 class and under the supervision of Terrot Glover, Esq., Sunderland, and named *Bempton*. She is fitted with compound surface-condensing engines of 160 N.H.P. by Messrs. T. Richardson & Sons, Hartlepool.

Western Lass.—On March 31st there was launched from the shipbuilding yard of Mr. W. H. Shilston, Plymouth, a new schooner, built to class twelve years A 1 at Lloyds, 99 tons register. On leaving the ways she was named the *Western Lass* by Master A. Shilston, son of the builder. She is to be commanded by Captain Quiller, of Plymouth, and is intended for the Newfoundland fish trade.

Ching-Wo.—On March 31st there was launched from the yard of her builders, Messrs. Raylton, Dixon & Co., of Middlesbro, a very handsome steamer, which has been built to the order of the China Shippers' Mutual Steam Navigation Co.'s Line. This vessel is 332 ft. over all, breadth 38 ft., depth moulded, 27 ft. She is built on fine lines, and will carry over 4,000 tons of tea. Her engines, by Messrs. T. Richardson & Sons, of Hartlepool, are on Mr. Wyllie's patent triple expansion principle, and are estimated to drive the vessel at a speed of not less than 12 knots on loaded trial, whilst her regular working consumption will be only about 16 tons per day. This vessel has been built in an extraordinarily short space of time, only eleven weeks having been spent in her construction, which, considering the size of the vessel, is the fastest bit of shipbuilding work ever done in the district. On leaving the ways she was christened the *Ching-Wo*, by Miss Inga Dixon, of Gunnergate Hall, the youngest daughter of the builder. On the adjoining berth, a duplicate vessel of steel is being constructed by her builders on their own account.

Eldorado.—On April 2nd Messrs. Earle's Shipbuilding and Engineering Co., Limited, launched from their yard at Hull a fine steel screw steamer, built to the order of Messrs. Thomas Wilson, Sons & Co., of the same town, for their passenger and mail service between Hull and Norway, and will run to Bergen and Stavanger. She will be a very valuable addition to the magnificent fleet of steamers which Messrs. Wilson already have engaged in the Swedish and Norwegian service, being much faster and more elegantly furnished than any previous ship. The following is a general description:—The vessel is built of steel, and classed A 1 in the Liverpool registry. Her dimensions are 235 ft. by 30 ft. by 15 ft. depth of hold, and being intended exclusively for passenger traffic is designed with very fine lines, and the utmost available space has been set apart for passenger accommodation. She has a long full poop and topgallant forecastle, the engines being placed as far aft as possible; the whole of the first-class accommodation is thus provided forward of the engines and boilers under the poop. A large iron deck-house is fitted on the poop, containing saloon entrance, music room, smoke room, chart room, and wheel house, and the top of this house, together with the poop deck, will afford a very spacious promenade. The saloon is exceptionally large, and will, like the music room, be fitted up in a very handsome style and lighted with the electric light; in fact, the whole of the ship will be lighted by electricity. There will be sleeping accommodation for 86 first-class passengers. The watertight bulkheads have been carefully constructed, so as to insure the safety of the vessel as far as possible in the event of collision. The collision bulkhead is designed with a conical form and is unusually strong, in order to resist pressure in case any damage is done to the bow. A small water-ballast tank is fitted forward for trimming the ship, and she will be rigged as a schooner with three pole masts. Messrs. Amos & Smith's combined hand and steam steering-gear is fitted amidships, and powerful hand-screw gear aft. The officers, engineers, and firemen are berthed aft near the engine-room, and the crew forward in the forecastle. The 'tween decks forward will be arranged for carrying emigrants. She will be fitted by the builders with their triple compound three-crank engines of 300 N.H.P., having cylinders 26 in., 40 in. and 68 in. diameter by 39 in. stroke, which will be supplied with steam of 150 lbs. pressure from two large steel boilers, each fitted with four of Fox's patent corrugated furnaces. These engines, it is calculated, will drive the ship at a speed of at least 14 knots.

Courage.—On April 13th there was launched from the yard of her builders, Messrs. Raylton, Dixon & Co., another small steam vessel, which has been built as carrier for the fishing trade, to bring the take of the trawling fleet from the fishing stations into the Billingsgate Market. She is the fifth they have built for the Great Yarmouth Steam Carrying Company, Limited, the other four having proved so very successful. Her principal dimensions are 128 ft. over all, 21 ft. beam, and 11 ft. 7 in. depth of hold, and she will be fitted with engines of 50 H.P., by Messrs. Blair & Co., Stockton; she will also be provided with steam winch and derrick gear for trawling, and her holds are specially arranged for carrying ice out to the fleet, and in stowing fish boxes on the return, the sides and below deck being protected by double lining of non-conducting material so as to exclude heat and preserve the fish. On leaving the ways she was christened the *Courage*. Her builders have at present in hand a large fleet of iron trawlers for the same trade.

General Gordon.—On April 16th there was launched from the shipbuilding yard of Messrs. J. P. Rennoldson & Sons, South Shields, a wooden steamtug. Length of keel, 86 ft.; beam, 18 ft.; depth, 9½ ft. She will be fitted by the builders with a single-side lever engine of 45 N.H.P., feathering wheels and steel flue boilers. This vessel has been built to the order of Mr. Anthony Irving, of Sunderland, in which port she will be employed in the towing trade. As she left the ways she was named the *General Gordon* by Master Irving.

Kathleen Mavourneen.—On April 16th there was launched from Messrs. Jack & Co.'s shipbuilding yard, Seacombe, near Liverpool, a splendid new steamship for the Drogheda Steam-packet Company, Limited. The vessel is one which the designers and builders may be justly proud of. The christening of the ship was very gracefully performed by Miss Jack, who, after giving the name, she, with a blow of a small mallet, severed the fastenings which kept the vessel on the stocks, and gradually and gracefully it glided on towards its native element, which was reached without the slightest mishap. The *Kathleen* is a charming model with most graceful lines, and she sits beautifully on the water. She is a fine steel paddle steamer, length 270 ft., breadth 31 ft. 3 in., depth 24 ft. 9 in., built for passenger and cattle service between Drogheda and Liverpool. She will be a valuable addition to the magnificent fleet of steamers of the Drogheda Company, being much faster, and fitted with all the latest improvements for carrying her cargo of live stock safely. The utmost available space has been set apart for passenger accommodation. She has a large full poop, and promenade deck the full length of the ship. The saloon is exceptionally large, and will be fitted up in handsome style and lighted with electric light, in fact, the whole ship will be lighted with electricity. There will be sleeping accommodation for fifty-two first-class passengers. The water-tight bulkheads have been carefully constructed so as to insure the safety of the vessel as far as possible in case of collision. The collision bulkhead is unusually strong, in order to resist pressure should any damage be done to the bow. She will be rigged as a schooner, with two pole masts. Messrs. Harrison & Co.'s combined hand and steam-steering gear is fitted amidships, and powerful hand gear aft. She is also fitted with Messrs. Emerson & Walker's (London) patent windlass. The officers, engineers, and firemen will be berthed near the engine room, and the crew in the forecastle. All the 'tween decks, lower hold, and main deck will be arranged for the conveyance of cattle, particular attention being paid to their ventilation. She will be fitted by Messrs. Jack & Co., Liverpool, with compound surface-condensing oscillating engines of 2,000 I.H.P., H.P. cylinder 47 in. diameter, L.P. cylinder 85 in. diameter, stroke 72 in. diameter. Steam will be supplied from two steel boilers, working pressure 85 lbs; each boiler will be fitted with Weir's patent hydrokineter. These engines, it is calculated, will drive the ship at a speed of at least 18 miles per hour. Powerful steam winches will be supplied, as also all the latest improvements for the rapid discharge or loading of the vessel; Chadburn's patent engine-room telegraph is also fitted. To Captain Lawrence Branigan, the Company's able and energetic manager and marine superintendent, is due the success which attended the construction of this latest addition to the fleet of the Drogheda Company. He carefully made out the specifications, superintended her construction, and gradually as piece to piece was added to her frame under his watchful eye she grew to be a marked success. The rest of the Company's fleet were built under Captain Branigan's superintendence, and for comfort, speed, and completeness in every respect, stand unrivalled amongst the cross-channel steamers. After the launch, luncheon was served in Messrs. Jack's office. Amongst those present were—Capt. Bell, R.N., City of Dublin Steampacket Co.; Miss Jack, Miss Edith Jack, Mr. Lumsden, Mr., Mrs. and Miss Jandrell, Mr. John Jack, Mr. Kelson, Capt. Croft, Mr. West, Miss Richards, Capt. Branigan, Capt. Tennison Smith, Mr. John McDougall, &c., &c. Mr. Jack, in proposing the health of Capt. Branigan, spoke in the highest manner of the ability he displayed in making out the specifications of the new ship, and the careful manner in which he looked after her construction. He hoped the Drogheda company would be pleased with their new purchase, and he had no doubt she would be a credit alike to the owners and those who built her. He felt it a great compliment indeed that the order was placed in his hands, and he trusted he had filled it fairly and honestly. Capt. Branigan responded to the toast, and said he was sure that the *Kathleen Mavourneen* would turn out a great success. He said his directors had done wisely in giving the order to Messrs. Jack, who had obtained a great reputation, and he knew they would not peril it by turning out inferior work. He complimented Miss Jack on the accomplished style she performed the christening ceremony, and in which she led one to believe she was an adept. The healths of Mr. Lumsden, Mr. McCall, and Capt. Bell having been proposed and responded to, the company separated.

Lord Devon.—On April 16th a sailing vessel, for the Salcombe Shipowning Company, was launched by Mr. Thomas Saunders, at Salcombe, the dimensions being 84 ft. length for measurement; depth of hold, 10 ft. 7 in.; breadth, 21 ft.; and classed at Lloyd's 10 years A1. Her registered tonnage is 99 tons, and she is expected to carry a cargo of 200 tons. Lord Devon is a shareholder and a director in the company, and the vessel being called after his lordship, he consented to perform the christening ceremony. In a few appropriate words his lordship wished the vessel success and named her the *Lord Devon*.

Prince Edward.—On April 16th there was launched from the yard of Messrs. W. Pickersgill & Son, Southwick, Sunderland, a screw steamer to the order of Mr. Thomas Seed, of Fleetwood. The principal dimensions of the vessel are:—Length between perpendiculars, 110 ft.; breadth extreme, 20 ft.; depth, 8 ft. The engines, which are on the compound surface-condensing principle, have been constructed by Mr. George Clark, of Southwick, and are 13 in. and 26 in. in the cylinders, with 18 in. stroke. The vessel is designed to carry passengers in the summer and cargo in the winter between Morecambe Bay, Blackpool, Isle of Man, and the Welsh coast, and is classed A1 at Lloyd's, with Board of Trade passenger certificate. She is fitted with a bridge amidships, and hatchway, with a winch and windlass combined, made by Messrs. G. & J. M'Onie, of Greenock. The holds will be fitted up for first and second class passengers. As she left the ways, she was christened the *Prince Edward* by Mrs. Seed, wife of the owner, and will be commanded by Captain W. A. Bond, of Fleetwood.

Trevean.—On April 17th there was launched from the shipbuilding yard of Messrs. J. Readhead & Co., West Docks, South Shields, an iron screw steamer of the following dimensions, viz.:—259 ft. by 36 ft. by 17 ft. 8 in. The vessel is classed 100 A1 at Lloyd's, has long raised quarter deck, bridge amidships, and topgallant forecastle, and has a deadweight capacity of 2,250 tons. She will be fitted with engines of 145 N.H.P. also built by Messrs. Readhead. This is the twelfth vessel built by the firm for Messrs. E. Hain & Son, St. Ives, Cornwall, and is named the *Trevean*. She will be commanded by Captain Wallis, and is intended for the Mediterranean and Black Sea trade.

Mona's Queen.—On April 18th there was launched from the yard of the Barrow Shipbuilding Company a fine paddle steamer for the Isle of Man Steampacket Company, of Douglas. The vessel is built of Siemens-Martin mild steel. Her dimensions are:—320 ft. by 38 ft. by 1 4ft. 6 in. depth of hold, with a gross tonnage of about 1,458 tons, and will be provided with accommodation for carrying about 1,500 passengers. Her fittings and appointments are of the most elaborate and elegant description, and will probably not be surpassed by any vessel afloat. Her saloons are very commodious; her upper saloon, measuring 75 ft. in length and 34½ ft. in breath, is panelled very handsomely in satinwood and walnut, decorated with gold, the entrance to it being 13 ft. by 14 ft. This saloon, together with the captain's room and state-room, is upholstered in peacock blue velvet. The design of the ladies' saloon, which measures 17½ ft. by 36 ft., is carried out in very fine sycamore and walnut, with gold moulding and capitols, and is upholstered in bronze green velvet. The lower saloon, which is 82 ft. in length and 35 ft. in breadth, is upholstered in crimson velvet. The sofas in this saloon, ladies' rooms, and state-rooms are so arranged as to be easily converted into sleeping accommodation. The smoke-room, 24 ft. by 34½ ft. is panelled in ash with oak framing and teakwood moulding, and upholstered in buffalo hide. Instead of the usual deck-house, as in other steamers belonging to the company, she has been fitted with a poop extending to the bridge, well lighted by unusually large side lights. The promenade deck, an advantage always appreciated by passengers, extends from side to side, and practically the whole length of the ship. The vessel will be steered by Messrs. Muir & Caldwell's steam steering gear amidships, and Hastie & Co.'s screw gear aft. The anchors will be worked by Messrs. Matthew, Paul, & Co.'s steam windlass, and she will also have a steam capstan fitted aft for warping purposes, supplied by the same makers. The boats will be four in number, and for the additional safety of passengers she will be provided with eight of Williams' patent double lifeboat seats on deck. The vessel will be propelled by double compound oscillating surface-condensing engines of about 5,000 I.H.P. The diameter of the high pressure cylinders is 50 in., and that of the low pressure cylinders 88 in., the length of stroke in each case being 72 in. The frames and other important parts are made of steel, for the purpose of securing lightness and great strength. The paddle-wheels are on the feathering principle, and are fitted with carved steel floats. The circulating water for the surface condensers is supplied by two powerful centrifugal pumps of the Barrow Shipbuilding Company's usual pattern, and powerful double donkey pumps and fire-engines are fitted in the engine-room for

the purpose of feeding the boilers, pumping out the holds, washing decks, and extinguishing fire in case of need. For this latter purpose a complete system of pipes is led the whole length of the ship, so that water can be supplied to any part. Steam is generated by four large double-ended boilers, constructed wholly of Siemens-Martin mild steel, and each having six furnaces. They will work at a pressure of 85 lb. Powerful fans, driven by independent engines, are fitted in the stokeholes, so that in case of need the boilers can be worked with forced draught, under which circumstances the power (and consequently the speed) will be greatly increased. The speed expected from the vessel is about 20 knots, and she will be the fastest of the Isle of Man Steampacket Company's already fine fleet. The ship and engines have been designed by the Barrow Shipbuilding Company. The hull has been constructed under the superintendence of Mr. George Hughes, and the engines under the superintendence of Mr. Lewin, the company's engineer. She is expected to be ready for her station on the 1st of July. The ceremony of naming the vessel was performed by Mrs. Fell, Mayoress of Barrow. The launch, which was very successful, was witnessed by a large number of spectators.

LAUNCHES—Scotch.

Grenadier.—On March 19th the *Grenadier*, a handsome paddle steamer, built by Messrs. James & George Thomson, Clydebank, for Mr. David MacBrayne, Glasgow, was launched. She is specially intended for the Oban and Staffa and Iona tourist traffic, being a consort to the *Columbia*, *Iona*, and *Chevalier*.

Earl Rosebery.—On March 21st, Messrs. Russell & Co., shipbuilders, launched from their shipbuilding yard, Kingston, Port Glasgow, an iron sailing barque, to the order of Messrs. Macallister & Co., London. On leaving the ways she was named *Earl Rosebery*. The vessel is 1,117 tons register, her dimensions being:—Length, 216 ft.; breadth, 25 ft.; and depth, 21 ft.

Seagull.—On March 21st Messrs. Hall, Russell & Co., Aberdeen, launched the *Seagull*, a steel paddle steamer, owned by the Indian General Steam Navigation Company, of London, and intended for passenger and goods traffic in the East Indies. She measures 230 ft. by 30 ft. by 13 ft., and is intended for a high rate of speed. She is to be fitted with triple-expansion engines of 280 N.H.P., and with steel boilers having a working pressure of 150 lb. per square inch.

Iron Screw Steamers.—On March 31 Messrs. Blackwood and Gordon, Port Glasgow, launched two iron screw steamers of the following dimensions;—Length, 66 ft.; breadth of beam, 18 ft. 3 in.; depth of hold, 7 ft.; tonnage, 70 tons each. These vessels have been built for Messrs. Tancred, Arrol & Co., South Queensferry. Mr. Gordon, Port Glasgow, supplies the machinery. They are to be used for the conveyance of material at the construction of the Forth Bridge.

Chili.—On March 31st there was launched from the shipbuilding yard of Mr. W. B. Thompson, Whiteinch, an iron sailing barque, named the *Chili*, built to the order of Messrs. A. D. Bordes & Son, Bordeaux. The vessel is 230 ft. long by 36½ ft. beam by 21 ft. deep, and is provided with every appliance for loading and discharging cargo, and her gross tonnage is about 1,300. She is fitted with double topgallant yards, two steam winches and donkey boiler, steam engine windlass, steel wire towlines, and every modern improvement. The naming ceremony was performed by Miss Bruce, Ethelstone, Broughty Ferry, daughter of Mr. David Bruce, shipowner, Dundee, agent in this country for the owners.

Snowdrop.—On April 1st Mr. W. B. Thompson, Dundee, launched an iron screw steam trawler, named the *Snowdrop*, a vessel measuring 96 ft. by 20 ft. by 9 ft. Her engines, which have been supplied by the builder, and are of 40 N.H.P., are of the triple-expansion type.

Abercorn.—On April 2nd there was launched by Messrs. Alexander Stephen & Sons, from their shipbuilding yard at Linthouse, an iron sailing barque of about 1,350 tons measurement, built under special survey to the highest class in Lloyd's. The vessel, which was named the *Abercorn* by Mrs. A. D. Dixon, of Kelvinside, has been built to the order of Messrs. P. H. Dixon and Co., Glasgow, and has been fitted with all the most recent and approved appliances for the speedy and effective handling of ship and cargo. Immediately after being masted at Clydevilla Crane, she will be placed on the loading berth, and will sail for Sydney (N.S.W.) under command of Captain Maccallum.

El Callao.—On April 2nd there was launched from the shipbuilding yard of Messrs. Ramage & Ferguson, Leith, an iron screw steamer of about 1,000 tons, built to the order of Messrs. Walker, Donald & Co., Glasgow, for the Orinoko Steamship Company. The principal dimensions are:—Length, 210 ft.; breadth, 31 ft.; depth, 36 ft. (moulded to upper deck). The steamer, which will be supplied by the builders with engines having cylinders 26 in. and 50 in. by 36 in. stroke, is specially designed for the South American fruit trade and for a light draught of water, in order to enable her to ascend the Orinoko River at all times. Accommodation for about 20 first-class passengers is provided in a large bridge-house, which leaves the 'tween decks clear for light cargo. As the vessel left the ways she was named the *El Callao* by Mrs. Darling, of Bonnington. This is the fifth steamer that Messrs. Ramage & Ferguson have built for Messrs. Walker, Donald, & Co. After the launch the *El Callao* was towed round to the Albert Dock to be fitted out.

Amy.—On April 2nd there was launched from Messrs. D. & W. Henderson & Co.'s shipyard, Partick, near Glasgow, a steel steam yacht named the *Amy*, which is claimed to be the largest British steam yacht afloat. She is a vessel of 850 tons, and measures 212 ft. (on load-line) by 28 ft. by 19 ft.; and her hull is constructed of five water-tight compartments—the designer, Mr. G. L. Watson. She is being fitted by the builders with a pair of direct-acting compound engines having a piston stroke of 36 in. and cylinders of 29 in. and 58 in. in diameter, respectively. A double-ended cylindrical steel boiler will supply steam at a working pressure of 100 lb. per square inch. Her mechanical and other appliances, internal fittings, decorations, &c., will be of the most perfect description. She is spoken of as a maritime palace, and as a triumph of the naval architect's craft. The owner is Mr. N. B. Stewart, a retired Glasgow merchant.

Tartar.—On April 4th Messrs. Scott & Co., Bowling, launched the *Tartar*, an iron screw steamer measuring 120 ft. by 19 ft. 6 in. by 9 ft. 6 in. She has been built to the order of Messrs. R. Walker and Co., Glasgow, and is intended for the fish trade. Engines are being fitted into the *Tartar* by Messrs. Muir & Houston, Glasgow.

Gartmore.—On April 14th Messrs. Archibald M'Millan & Son, Dumbarton, launched the *Gartmore*, a steel barque of about 1,100 tons gross register, measuring 215 ft. by 34 ft. by 20 ft., and built to the order of Messrs. Thomson, Dickie & Co., Glasgow.

Tay.—On April 15th a steamer, named the *Tay*, was launched from the yard of Messrs. Pearce Brothers, at Dundee, for the Dundee and Newcastle Shipping Company. She is 106 ft. in length, 19 ft. broad, has engines of 30 H.P., and will carry about 150 tons of cargo. The christening ceremony was performed by Miss Plenderleath. Mr. Joseph Cartwright, late of the *Basic*, of Grangemouth, has been appointed to the command.

Loch Carron.—On April 15th Messrs. Barclay, Curle & Co., Limited, launched from their yard at Whiteinch an iron four-masted sailing vessel, of 2,120 tons register, for Messrs. Aitken, Lilburn & Co., to augment that firm's fleet of vessels carrying the flag of the Loch Line. As the vessel left the ways she was named the *Loch Carron* by Miss Agnes Macfarlane. The new ship, which is a sister to the *Loch Broom*, launched a couple of months ago from the same yard, is 275 ft. long, 42¼ ft. broad, and 24 ft. deep. She is fitted up with all modern appliances, including steam pumps, &c., and great care has been exercised in the arranging for passenger accommodation and convenience of captain and crew.

Lawada.—On April 15th Messrs. William Denny & Brothers launched from the Leven shipyard, Dumbarton, the steamer *Lawada*, a steel screw steamship for the British India Steam Navigation Company, Limited. The *Lawada* is a vessel of about 3,310 tons gross register, and of the following builders' dimensions:—Length between perpendiculars, 340 ft.; breadth (moulded), 42 ft.; depth (moulded), 29 ft. She is classed at Lloyd's 100 A1, three-decked, and is constructed on the continuous cellular bottom principle. She is fitted with saloon and state-room accommodation for 32 first-class and 16 second-class passengers. The vessel will be fitted by Messrs. Denny & Co. with direct-acting surface condensing engines of about 2,000 I.H.P., designed on the triple-expansion principle, having four cylinders. The ceremony of naming the *Lawada* was performed by Mrs. Peter Denny, jun., of Bellfield.

Katrina.—On April 16th Messrs. Ramage & Ferguson, Leith, launched an iron steam yacht, of 400 tons y.m., for Mr. J. Anderson, of the Royal Polytechnic, Glasgow. The dimensions are:—Length, 160 ft.; breadth, 22 ft. 6 in.; depth, 13 ft. 6 in. (moulded). She will be fitted by the builders with compound surface condensing engines, 22 in. and 40 in. by 25 in. stroke, and 70 N.H.P. As the vessel left the ways she was named the *Katrina* by Messrs. E. P. Anderson, Glasgow.

Ulunda.—On April 16th Messrs. Alex. Stephen & Sons launched from their shipbuilding works at Linthouse, Govan, a passenger and cargo steamer, of about 1,820 tons, built for the Halifax Steam Navigation Company, Halifax (Nova Scotia). The vessel has been built to the highest class in Lloyd's, and combines all the most recent improvements in construction, and has appliances of the most approved kind for working ship and cargo. The saloon and rooms for captain, officers, engineers, and petty officers, together with galleys and other usual fittings for a passenger vessel, are arranged in a long bridge-house amidships. The crew are accommodated in a forecastle under the spar-deck forward. The vessel is fitted with turtle-backs forward and aft, water-ballast arrangements, steam steering gear, steam winches, &c. The engines, fitted on board before launching, have cylinders 33 in. and 62 in. diameter, by 42 in. stroke, and work at 90 lb. pressure. The vessel, which was named the *Ulunda* by Mdlle. Ficquet, Havre, is a sister ship to the *Damara*, recently launched at Linthouse for the same owners, and has been superintended by Captain A. H. Taylor, Aberdeen. She will be immediately placed on the berth for Quebec and Montreal.

Ossian.—On April 17th Messrs. Thomas B. Seath & Co. launched from their shipbuilding yard at Rutherglen, a little saloon steamer of 100 tons burthen, intended for the tourist traffic on Loch Etive in connection with the Highland circular tours and general passenger trade. She will be supplied with compound surface condensing engines of 120 H.P., with steel tubular boilers, 100 lb. working pressure. The vessel, which is named *Ossian*, has been built to the order of Mr. James Murray, Taynuilt, and is of the following dimentions:—Length, 121 ft.; breadth, 16 ft.; depth, 9 ft. Her estimated probable rate of speed is 12 miles an hour.

Titan.—On April 17th Messrs. Scott & Co., shipbuilders, Cartsdyke, launched from their yard a screw steamer of 2,300 tons, built to the order of the Ocean Steamship Company, of Liverpool, for their China Line. The following are her dimensions:—Length, 320 ft.; breadth, 36 ft; and depth, 26 ft. Her engines, also constructed by Messrs. Scott & Co., are of Holt's tandem design, having cylinders 27 in. and 58 in. diameter, with a stroke of 5 ft., and will indicate 1,500 H.P. The boiler weighs 72 tons finished, is of steel throughout, and fitted with Fox's patent corrugated furnaces. The vessel has been constructed above the requirements for the highest class in Lloyd's, and is fitted with the best modern appliances for working cargo. She has been named the *Titan*, and is sister ship to the *Telamon*, recently built for the same company by Messrs. Scott & Co.

Royal Briton.—On April 18th Messrs. Edward Finch & Co., Limited, launched from their shipbuilding yard at Chepstow, a very powerful and handsomely-modelled screw tug, built to the order of Messrs. Gibbs & Lee, of Cardiff. Her principal dimensions are:—Length over all, 93 ft. 6 in.; breadth, 18 ft. 1½ in.; depth, 9 ft. 8½ in. She will be fitted with compound surface condensing engines, having cylinders 18 in. by 36 in. by 24 in. stroke, and a boiler 9 ft. 6 in. by 11 ft. 6 in., designed for a working pressure of 85 lb.; has accommodation aft for captain, and forward for crew, together with one spare state room, large cross bunker between engines and boiler, and will be fitted with all the most modern appliances. As she left the ways she was gracefully christened *Royal Briton* by Miss Gibbs.

Dolphin.—On April 18th Messrs. Blackwood & Gordon, Port Glasgow, launched a paddle tug steamer, named the *Dolphin*, which has been built by Messrs. Tancred, Arrol & Co., South Queensferry. She is a vessel of about 80 tons, and measures 90 ft. by 17 ft. by 8 ft. She is being fitted with engines of the grasshopper type and of 40 H.P. She is to be engaged for towing purposes in connection with the extensive operations involved in the construction of the Forth Bridge, and has been built under the superintendence of Messrs. A. & R. M'Gechan, marine surveyors, Glasgow.

Indra.—On April 18th there was launched from the Dundee yard of Mr. W. B. Thompson, of Dundee and Glasgow, a tug steamer named the *Indra*, built to the order of the Ganges Steam-tug Company, Limited, Calcutta, per Messrs. David Bruce & Co., Dundee, and intended for towing purposes on the Hooghly. The *Indra* has been built of iron to the highest class at Lloyd's, and is of the following dimensions:—Length over all, 217 ft. 6 in.; breadth (extreme), 31 ft. 8 in.; and depth of hold, 15 ft. 6 in. She will be propelled by twin screws, each driven by independent engines. The engines, which are of the usual compound surface-condensing type, are an exact duplicate of each other, with cylinders of 30 in. and 60 in., and stroke 33 in. They are expected to develop 2,200 I.H.P. collectively, and it is calculated that a speed of at least 18 miles an hour will be attained. Steam is supplied by two large double-ended boilers, with 12 furnaces, which have been specially constructed for burning inferior coals. In the design and construction of the propellers, which are of steel, special care has been taken to ensure the most satisfactory results when towing, and each screw is completely isolated from the other. The towing gear is of an unusually massive character, and has been arranged in accordance with the requirements of the special trade for which the *Indra* has been built. Two powerful steam engines placed under the main deck aft form part of the towing arrangements, rendering them very complete. Amidships a range of iron deck-houses encloses the engine-room, boiler space, and passenger accommodation, the whole surmounted by a promenade deck, from which the vessel is navigated. The signalling arrangements include three Bassnet's double-repeating telegraph instruments—two placed at the steering wheel, and one near the engine-room aft. The main deck is almost wholly of iron, sheathed with three-inch teak, and the promenade deck is teak also, upon which is placed the s'eam steering-gear (Hastie's patent) and the boats, &c. Under the turtle-back forecastle forward is placed one of Harfield's patent combined steam windlass and capstan, in conjunction with a powerful anchor crane. The fore-end of the 'midship deck-house has been fitted for the accommodation of passengers. When required, steerage accommodation can be given in the 'tween decks, portlights having been fitted fore and aft to meet this possibility. The officers' and engineers' quarters are under the main deck forward, and under the main deck aft accommodation has been provided for the crew. Special attention has been paid to ventilation. In the fore and after ends water ballast trimming tanks have been constructed, and the large bunker space available adapts the vessel in a special manner for long deep-sea towing. A substantial elm fender extends all round the vessel, and the after end affords protection to the propellers. The steamer is lightly rigged as a fore-and-aft schooner, with two pole masts carrying square foresail and jib-headed trysails. The *Indra* is the fourth twin-screw steamer built by Mr. Thompson, the last, the *Retriever*, a smaller vessel, now towing on the Hooghly, having been launched from the same yard about a year ago. The *Indra*, while specially built for towing, can be used as a despatch boat or mail steamer, as her speed and power render her available for any purpo e where great speed is required. The hull, machinery, and boilers were all designed and constructed at Mr. Thompson's yard and engine works in Dundee. The christening ceremony was performed by Miss Methven, daughter of Mr. James Methven, Kirkcaldy, and the ship was launched by Miss Henderson, daughter of Mr. Frank Henderson, M.P.

Brynhilda.—On April 20th Messrs. Alex. Stephen & Sons launched from their shipbuilding works at Linthouse, a fine iron sailing ship of about 1,550 tons, and 100 A1 class at Lloyd's, under special survey. The vessel, which was named the *Brynhilda* by Mrs. J. Albert Black, Lynedoch-street, has been built for Messrs. Jas. W. Carmichael & Co., of New Glasgow, Nova Scotia, and will be a very handsome addition to the fleet of that enterprising firm. The design of the *Brynhilda* includes a poop, deck-house, and topgallant forecastle, with superior accommodation for captain, officers, passengers, and crew, and the vessel is fitted with all the best appliances for working ship and for loading and discharging cargo. The *Brynhilda* will shortly be despatched under the command of Captain Richard Meikle for Sydney, New South Wales. She is the third vessel launched by Messrs. Stephen this month.

Paddle Wheel Steam Launch.—On April 22nd a steel paddle wheel steam launch, 65 ft. long by 11 ft. broad, was launched by Messrs. Matthew Paul & Co., from their works at Dumbarton. She has been built to the order of Messrs. P. McIntosh & Sons, Glasgow, for the Indian Government, under the superintendence of Messrs. MacNicoll & Co., Glasgow, and will be fitted with a powerful pair of engines by the builders to give a speed of 10 miles an hour on a draught of 18 in.

TRIAL TRIPS.

Eastwood.—On March 21st the *Eastwood*, s., built by Messrs. Earle's Shipbuilding and Engineering Company, Limited, Hull, to the order of Robert Jameson, Esq., of the same town, was taken on her official trial trip. The dimensions of the vessel are as follows:—Length, 256 ft.; breadth, 34 ft.; depth of hold, 17 ft. She is built to the highest class in the Liverpool Registry, has a raised quarterdeck aft, bridge over engines and boilers, and topgallant forecastle forward. She is rigged as a schooner, with two pole masts of iron, has water-ballast provided in aft hold and engine space, and is fitted with steam steering gear amidships, and screw gear aft. She has been fitted by the builders with their triple compound three-crank engines, steam for which is supplied from a large single-ended steel boiler, made for a working pressure of 142 lbs. per square inch, this being the tenth set of triple compounds completed by Messrs. Earle's company. Owing to there being a strong wind from the N.W., and the vessel being very light, she was not taken on the measured mile off Withernsea, but a good run was made in the Humber, near the mouth of the river, during which the engines worked remarkably cool and well.

Transition.—On March 28th there proceeded to sea from the Middlesbro' Dock the s.s. *Transition*, which has been built to the order of J. M. Lennard, Esq., by Messrs. Raylton Dixon and Co., the launch of which we noticed last month, and pointed out that she is the first vessel built of steel manufactured in Middlesbro'. Her dimensions are 267 ft., 36 ft., 19 ft. 6 in. moulded, with a deadweight capacity of 2,350 tons. The engines, which were built by Messrs. Blair & Co., of Stockton, are on the new triple expansion principle, having three cylinders working direct on to three cranks with a boiler pressure of 160 lbs., and will doubtless show an economy in coal consumption; which by previous experience may be taken as at least 30 per cent. The engines, which are of 140 N.H.P., worked perfectly on the trial trip, giving a speed from 9½ to 10 knots. She has loaded a full cargo of bowl chairs and railway material for Alexandria, with which she proceeded direct after a most satisfactory trial trip.

Kimberley.—On March 30th the iron spar-decked screw-steamer *Kimberley*, built by Messrs. William Hamilton & Co., Port Glasgow, had her official trial trip on the Clyde. She is a vessel of 4,000 tons gross register, with a deadweight carrying capacity of 5,100 tons, and measures 350 ft. by 41 ft. 5 in. by 32 ft. 6 in. She has been built under Government inspection, and fulfils all the Admiralty requirements for carrying troops, including eight watertight compartments. The engines, which were supplied by Messrs. Duncan Stewart & Co., Glasgow, are of 2,500 I.H.P., the cylinders being 44 in. and 82 in. in diameter, with piston stroke of 4 ft. 6 in. The *Kimberley* has been built to the order of Messrs. Henry Ellis & Sons, of London, and is to be under the command of Captain Hubbard, of the Royal Naval Reserve, her first destination being the Cape. On trial on the measured mile she attained a speed of fully 13 knots an hour.

Royal Prince.—On March 31st the steamer *Royal Prince*, recently built by Messrs. Short Brothers, for Mr. James Knott, of Newcastle, was taken on her trial trip. The vessel is fitted with the first pair of engines of the new triple expansion three-crank type made on the Wear. They are from the establishment of Mr. John Dickinson, of Palmer's Hill Engine Works, and were made from the designs of Mr. W. Crawford, manager. The *Royal Prince* was tested over the measured mile off Whitley, both with and against the current, and attained a mean speed of 11 knots, with a total I.H.P. of 767, the revolutions of the engines being 74 per minute. The steel boilers, with which the vessel is fitted, gave every satisfaction, and showed a great saving in the consumption of coal.

Red Rose.—On March 31st Messrs. Edward Finch & Co., Limited, of Chepstow, ran a very successful trial trip of the exceedingly powerful and handsomely modelled ocean going screw tug *Red Rose*, built to the order of Mr. David Guy, of Cardiff. She has been specially designed and built for towing the largest sailing vessels from any distant port to Cardiff. Her principal dimensions are—Length, 120 ft.; breadth, 22 ft.; depth, 12 ft. She has been built under Lloyds' special survey for the highest class, has water ballast in after peak, a small hold for coal at each end of engine and boiler room, also a large cross bunker between engines and boiler; pilot bridge, upon which is placed chart and wheel house; saloon cabin, with state room, etc. aft, and accommodation for captain and crew forward under deck. A large iron deck house is carried over the engines and boiler, in which is placed the galley, bunker hatch, &c. She has steam windlasses, telegraph from bridge to engine room, and all the latest improvements, carries two boats, and is rigged as a two-masted schooner. She has been fitted by the builders with a pair of compound surface condensing engines of 99 N.H.P., and an enormous steel boiler, 14 ft. 6 in. diameter, designed for a working pressure of 90 lbs. After steaming continuously for several hours and maintaining a speed of 13 knots, proving herself not only the largest but at the same time the fastest tug afloat in the Bristol Channel, she entered Cardiff, everything having proved satisfactory.

Hispania.—On April 1st the new steamer *Hispania* was taken out to sea for her trial trip. She has been built by the Tyne Iron Shipbuilding Company, Willington Quay, and engined by Wigham Richardson and Co., Neptune Engine Works, Low Walker. The *Hispania* is fitted with triple-expansion engines, and on trial proved in every way most satisfactory; the engines at 85 revolutions indicated 940 H.P., the ship steaming 12 knots. The vessel has been built to the order of Messrs. H. Clarkson and Co., Billiter-street, London, for Mr. Adolph Meyer, Gothenburg, under the superintendence of Mr. T. Todd, engineer and naval architect, London.

Snowdrop.—On April 4th the steam trawler, *Snowdrop*, recently built and engined by Mr. W. B. Thompson, Dundee, had her official trial trip, which was from the Tay to the mouth of the Forth and back. Her engines, which are of the triple expansion type, work admirably, there being no heating or hitch of any kind. They indicated about 200 H.P., the pressure in the boiler being 140 lb. per square inch. Their consumption of coal was only 1·67 lb. per I.H.P. per hour.

Lake Superior.—On April 7th the trial trip of the Beaver Line steamer *Lake Superior* took place. She is owned by the Canada Shipping Company, and is the third vessel supplied to them by her builders, Messrs. J. & G. Thomson, Clydebank. She is the largest steamer of the Beaver Line, and is a vessel of 4,562 tons gross, with a deadweight carrying capacity of close upon 5,000 tons; she measures 410 ft. by 44 ft. by 33 ft. Besides providing for a large number of saloon passengers, the vessel has accommodation for 880 emigrants or 488 cattle. All her fittings and mechanical appliances are on a very perfect scale, and, as regards her structure, she fulfils all the Admiralty requirements. Her engines, which developed 4,200 H.P. with a speed of 14 knots, and at three-quarter speed gave 12½ knots, have cylinders of 48 in. and 90 in. respectively, with 5 ft. stroke. Steam of 90 lb. pressure is provided by two double-ended steel boilers 18 ft. 6 in. in diameter and 18 ft. long, the largest yet made on the Clyde.

Princess Maud.—On April 7th the new screw steamer *Princess Maud*, built and engined by Messrs. D. J. Dunlop & Co., Port Glasgow, ran her official trial trip on the Clyde. She is a vessel of about 1,000 tons, and measures 208 ft. by 29½ ft. by 15 ft. She is owned by Messrs. Langland & Sons, Glasgow, by whom she is to be employed in the Liverpool and Glasgow, and Liverpool and Dundee trades. The engines have cylinders 28 in. and 56 in. in diameter, respectively, with piston stroke of 42 in. The speed attained on the measured mile at Skelmorlie was equal to about 12 knots per hour.

Pescador.—On April 9th a steel steam launch, which was lately launched by Messrs. Cochran & Co., of Birkenhead, was tried, when the results gave every satisfaction to those on board. The vessel is named the *Pescador*, and has been built to the order of Mr. G. Petrie, for service on the west coast of South America. The principal dimensions are:—Length, 42 ft. 6 in.; breadth, 9 ft.; depth, 5 ft. 3 in.; and the machinery is constructed on the system now adopted by the builders which dispenses with the air pump, and thus secures the greatest possible simplicity without any loss of efficiency. The cylinders are 6 in. and 12 in. in diameter by 10½ in. stroke. The boiler is Cochran's patent multitubular type, and works with a natural draught. The vessel has been shipped on the Pacific Steam Navigation Company's s.s. *Valparaiso* for the west coast.

Haiphong.—This screw steamer, which has been built and engined by Messrs. Wigham, Richardson & Co., Neptune Engine Works, Low Walker, for the Douglass Steamship Company of Hong Kong, proceeded lately to sea on her trial trip. Her engines have cylinders 31 in. and 62 in. respectively by 42 in. stroke, working at 90 lb. pressure. A series of runs over the measured mile were made off Whitley, when a mean speed of 12¼ knots was obtained. During the whole of the runs the engines worked with the greatest smoothness, and gave every satisfaction to those interested.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—ED. M. E.]

THE POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—In your April issue, both "Marine Engineer" and "Sea Going Engineer" give us some wholesome truths with regard to firemen holding the position of engineers. Permit me to draw your attention to another class of candidates for marine engineer honours, viz., those who have served their apprenticeship as pattern makers in country shops, where marine engines are never built, yet procure positions as third engineers. With twelve months' sea service and a second-class certificate, there is brought into requisition "Men" holding responsible positions, who cannot even handle a hammer and chisel. Upon long voyages, where three engineers only are carried, and the third probably inexperienced, it makes matters very serious. As this is no fancy sketch, it requires no further comment from

CRANK.

To the Editor of THE MARINE ENGINEER.

SIR,—Having read the letter of "Marine Engineer" in your last issue, I should like to add a little to his remarks on the subject of the lowering of the profession of sea-going engineers, but before going further I should like to point out a discrepancy which arises in his letter. If he will refer to the Merchant Shipping Act Amendment Act, 1862, *re* engineers' certificates of competency, he will find in clause 13, "Service in the engine room for qualifying a candidate to be examined for a second-class engineer's certificate must only be in those capacities which afford opportunities of obtaining practical experience as an engineer, and service in capacity of fireman, stoker, donkeyman, greaser, winchman, labourer, engineer's steward, or any other capacity than that of engineer taking watch will not be accepted." So that a fireman or trimmer cannot, by any amount of service as such, develop into a "full-blown engineer." Given those conditions, I maintain that the man who has overcome all these difficulties by perseverance and proved ability, and successfully obtained a a certificate of competency (even if he has not served an apprenticeship), does not lower the profession, but raises it and himself also. Now, sir, I think if we calmly and dispassionately consider this, we shall find that this is not the cause of the position of a sea-going engineer being at so low a standard as it is at the present time, and as this is a matter worthy of the consideration of marine engineers, I trust you will kindly allow me space to point out what, in my opinion, has led to it, for remove the cause and the effect will cease itself.

1st. During the years of brisk trade engineering received a tremendous accession to its ranks in the shape of apprentices, and of these, on the expiration of their apprenticeship, an equally large number determined on sea-going. This increased supply came into the market at a time when the demand was decreasing and led it to decrease still further, from which it has never risen to its former prosperity.

2nd. An engineer having served an apprenticeship, after having been at sea for twelve months, succeeds in being crammed for the Board of Trade examination and secures his second-class certificate. Now every sea-going engineer knows that while there has been no great demand for men who hold first-class certificates, there has been, and still is, a correspondingly great demand for second-class. And why? because an additional twelve months with a second-class certificate has enabled or qualified its owner to be crammed for a first. And here comes one of the causes—A youth with but two years' experience at sea is adjudged by the Board of Trade to take charge of a vessel of any power.

3rd. It has been, and is now, the custom of many chief engineers, to leave the management (as far as repairs and examination is concerned) to the second and third whilst in foreign ports, their time being fully taken up with visiting and shore going. What wonder that steamship owners value their services so lightly, and rather regard them as a kind of white elephant saddled on them by the Board of Trade!

4th. It has been proved in courts of law that the captain of a steamer is the commanding officer, and that the engineer only holds a second rank; and yet in the face of this fact we have had, and still have, many engineers who persistently ignore the authority of the captain. It is a well-known fact that captains have always (almost to a man) looked upon engineers with a jealous eye. But, sir, I hold that the duty of an engineer is to comport himself in all his dealings with the captain and all others as a gentleman, so that he may have the satisfaction of knowing that he has done his duty, whatever reports may be given of his conduct.

5th. Another, and certainly not the least, cause is, that having first-class certificates, few sea-going engineers continue to have any interest in their further advancement. Very few, indeed, aspire to the extra grade, or to benefit themselves or others by their further study. We find the use of indicators almost discontinued in cargo vessels. And why? simply because if it was used at all it was often for the purpose of covering the neglect of the engineer. Cases have been known of diagrams taken by the score when good and reserved for use, and no more taken for months, the inspecting engineer having one of the old ones handed to him (with perhaps a slight manipulation) periodically. What wonder, then, that finding them made use of to falsify the condition of the engines, they have been removed? Now, sir, I am not raising a cry against sea-going engineers; but my most sincere wish is to see them rise to the position of honour which they once held, and to help them to do this I would point out some ways which would lead to that result.

1st. I heartily fall in with the suggestion of "Sea-going Engineer" in your last issue, that everyone, before signing as engineer of any grade, should be compelled to undergo a slight verbal examination as to his practical knowledge of a marine engine. This would do more to allay the anxiety of a chief engineer as to the ability of those under him than anything else.

2nd. That no certificate of competency be issued to any foreigner, unless he be a naturalized British subject.

3rd. That the age necessary to be qualified for a second-class certificate be raised to twenty-four years, and that two years' service with second-class be necessary to qualify for first. We would thus have men with more experience in charge, and consequently the demand would increase and with it the remuneration.

4th. That each vessel be compelled to have an indicator on board, and that the Board of Trade survey should include the taking of diagram by or under the supervision of Board of Trade surveyor. This would increase the interest and maintain our efficiency.

And now, sir, in conclusion, we live in an age of advancement, and the marine engineer has before him a great future. Every day sees some rapid stride taken towards the alteration of motive power, and I believe, sir, the engineer of the future must be chemist, electrician, and finally navigator of our mercantile marine. Therefore let us look to those great helps which may raise us to that honourable point, and not to the extinction of a very few individuals who, by their energy and perseverance, overcome the many difficulties placed in their path. Apologising for encroaching so largely on your valuable space, I beg to remain,

Yours truly,

Stockholm, *April 13th*, 1885. T. C.

SCIENTIFIC WAR.

To the Editor of THE MARINE ENGINEER.

SIR,—Longfellow tells us—

"Be not like dumb cattle driven,
Be a *hero* in the strife."

This requires changing to—

"Show your *science* in the strife—"

as more practical *applied science*.

When big boats are found too large and too heavy for the Nile, &c., why not use smaller ones in larger numbers? They are more easily transported on iron-shod keels and bilge-keels like skates or sleighs, with fluted steel-plated grooves, sliding quickly over tightly stretched steel-wire-rope hawsers along the ground as extemporised tramways, or movable and easily transportable

railways. Sleigh boats, suitable both for life-boats and pontoons, can be made to pack inside and over each other indiscriminately haphazard in groups of uniform and similar dimensions and forms for saving of space and stowage (like soup plates). And in a similar manner the very heaviest siege or naval guns can be landed anywhere and transported overland anywhere, on and over grooved or fluted wheels running on wire-rope railways with a portable tackle-purchase, with men, horses, or traction engines dragging them with sheer force, helped by every possible means for facilitating the motion.

Hence the questions suggest themselves, "With two such lessons Why forget," &c. that Khartoum might have been reached before it was "Too late, too late, ye cannot enter now"?

These lessons will have to be relearnt on the Indus and the frontier of Russian Afghanistan, before it is *too late* again, as History is so very apt to repeat itself, unless the British Government learn these two necessary lessons of modern military requirements and learn to avail themselves of ready-made existing facilities for the rapidly accelerated transport of war *matériel*, food, ammunition, and men *everywhere*. Your kind attention and that of your numerous readers have already been drawn to proposals for giving increased efficiency to all existing guns, and the stern necessity for the arming of British merchant vessels, so that

"This England never did, or never shall
Lie at the feet of a proud [German ?] conqueror"

that wants the Rhine, the Danube, Denmark and Holland.

"Men and nations, etc., all were his.
Trust not for freedom to the Franks;
They have a king who buys and sells.
In native swords and native ranks
Your only hope of freedom dwells," &c.

R. E.

GENOA, *March 9th*, 1885. GEORGE FAWCUS.

THE FLEET.

(On its reported Insufficiency.)

You—you—*if* you have fail'd to understand—
The Fleet of England is her all in all—
On you will come the curse of all the land,
If that Old England fall,
Which Nelson left so great—

This isle, the mightiest naval power on earth,
This one small isle, the lord of every sea—
Poor England, what would all these votes be worth,
And what avail thine ancient fame of "Free,"
Wert thou a fallen State?

You—you—who had the ordering of her Fleet,
If you have only compass'd her disgrace,
When all men starve, the wild mob's million feet
Will kick you from your place—
But then—too late, too late.

TENNYSON.

The several contracts for the construction of ironclads and belted cruisers resolved upon by the Lords of the Admiralty were, on April 12th, determined on the recommendation of Mr. Barnaby, the Director of Naval Construction. Of the five belted cruisers, two have been given to Messrs. Napier, of Govan; two to the Palmer Shipbuilding Company, of Newcastle; and one to Earle's Shipbuilding Company, of Hull. Of the two ironclads, one has been given to the Thames Ironworks, and one to Sir William Armstrong & Co. The time given for the construction of the belted cruisers is two years and three months, and for the ironclads three years and a half. The *Times* understands that the price to be paid by the Government for the armour-clad to be built by the Thames Ironworks is £601,000, and that ordered from Sir William Armstrong & Co. £604,000. The engines for both are to be supplied by Messrs. Humphreys & Co. The price to be paid for the belted cruisers was £215,000 each for the one to built by Earle's Shipbuilding Company and the two by Messrs. Napier, of Govan, and £224,000 each for the two by Palmer's Company, of Jarrow.

Messrs. William Jessop & Sons' Steel Stern Frames.—Messrs. William Jessop & Sons (Limited), Brightside Steel Works, have a speciality in the manufacture of steel stern frames for ships, which they have recently added to their business. Some time ago they undertook the production of a large stern frame for a twin-screw steamer, building by Messrs. Harland & Wolff, shipbuilders, Belfast, for one of the London and North-Western Railway Company's steamers plying between Holyhead and Dublin. The total length of the frame is 21 ft., the breadth of the bottom 17 ft., and 10 ft. across. This is the largest stern frame in area that has ever been made. It weighs 13 tons, and it was cast solid in one piece in crucible steel. About a third of the way from the bottom two large bosses project five feet on each side, so that altogether the frame was about as awkward a piece of mechanism to carry on a railway as ever was put on to a truck. It was delivered to the Midland Company on Sunday, the 15th March, that day being selected as the one on which the least inconvenience would be caused to the traffic, as during its progress both lines were blocked. The frame proceeded all right as far as Woodlesford, near Leeds, where it came in contact with the columns of a bridge, and it had to remain at Woodlesford till last Sunday.

Centrifugal Pumping Machinery.—We understand that Messrs. John & Henry Gwynne, of Cannon-street and Hammersmith, London, have secured the contract for supplying their machinery to the new Government Docks at Sebastopol and Vladivostock, the pumping engines of the *Invincible* type being the ones selected. In the former case the duty required of the machinery is somewhat exceptional, the lift when finishing being 45 ft. We also understand Messrs. Gwynne have in hand two sets of similar machinery for docks in the Straits Settlements, and have only recently delivered to the Mersey Docks and Harbour Board, Liverpool, four large pumping engines, likewise of the *Invincible* type, each being capable of discharging 130 tons per minute.

The requirements of the Admiralty in respect of torpedo warfare are proving a good thing for the chain makers in the Cradley, Old Hill, and surrounding districts. Certain of these makers have booked orders for hundreds of tons of shackles, rings, chains, and the like, to be used in the construction of iron netting or link armour, which will be thrown over the sides of gunboats as they lie at anchor, to prevent successful attacks be torpedoes. Further large inquiries are also being received, and some of them are, there is reason to belive, on account of the Russian Government.

German Steamships.—A syndicate has just been formed at Hamburg to enter into competition with the subsidised Eastern Line of steamers, on the following basis. The new line will be composed of vessels of 3,500 tons, and an average speed of 11½ knots. They will touch only at Brindisi, thence going direct through the Suez Canal to Japan. There will be an Adriatic Branch Line between Trieste and Brindisi. The company calculates that the necessary capital will be 10,000,000 marks. The subscriptions hitherto have been very insufficient, as all the East Asian houses in Hamburg are convinced that the proposed line will not be able to meet English and French competition. According to the *Frankfurter Zeitung*, however, another company, called the German Steamer Company of Hamburg, has decided on independent competition with the subsidised line.—*Standard*.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from March 20th to April 13th, 1885.

3350 J. Nelson. Water ballast tanks for sea-going vessels.
3369 J. Hoyle. Preventing corrosion.
3373 T. Dipple. Valve cocks.
3398 Chiswell (Schaffer & Budenberg). Centrifugal governors.
3399 Chiswell (Schaffer & Budenberg). Pressure reducing valves.
3412 W. Gibson, G. Wilson, and W. J. Clark. Prevention of corrosion or incrustration in steam boilers.
3413 R. L. Weighton. Operating the valves of steam and other engines.
3423 C. E. Chamberlain. Filtering.

3432 W. Harvie. Ship's anchor.
3438 G. Parfitt. Pumping engines.
3442 Boult (C. H. Washburn). Steering gear.
3444 J. A. Wade & J. Cherry. Pumps.
3448 J. J. Varley. Valve stoppers.
3458 R. B. Evered. Valve cock.
3476 W. W. Smith. Anchors.
3503 T. J. Cammell. Pumps.
3522 R. Lander. Lubricators.
3539 T. Hodgson. Stopping leaks in vessels.
3544 J. Dawson and A. Senior. Valves.
3548 W. & J. B. Morrison. Apparatus for hauling the nets of fishing boats.
3551 J. Walsh. Filtering.
3559 L. J. Crossley, R. Hanson, & J. J. Hicks. Water gauges.
3569 Jensen (J. Richards). Steam engines.
3574 Lake (A. Helaers). Filtering.
3580 G. Swindells. Hollow fire bars of steam boilers.
3583 L. G. Moore. Portable anti-fouling anchor.
3587 W. J. Murgatroyd. Pistons and pump buckets.
3588 Heys (M. Berry). Steam engine governor.
3593 H. C. Lobnitz. Compound steam engines.
3620 J. Leitch. Sea water distilling apparatus.
3634 W. Sisson. Valve motions of steam engines.
3657 R. Morhard. Submarine vessels.
3681 J. T. James. Supporting and facilitating the raising and lowering of top-masts.
3688 D. P. G. Matthews. Expansive valves.
3718 R. Wyllie. Condensing steam engines.
3722 D. Purves. Furnaces for steam boilers.
3736 Lake (L. Broussas). Steam boiler and other furnaces.
3791 W. Black. Lighter or floating vessels.
3797 R. Small. Valves.
3814 J. Corry & J. F. Sleat. Spherical rotary engines.
3818 T. N. Robinson & J. P. Fielden. Expansion gear for steam engines.
3885 W. J. Last. Motors or pumps.
3929 S. G. Browne. Valve gear for steam engines.
4012 S. Vapper. Cocks and valves.
4022 Johnson (A. Bachmeyer & Co.). Lubricators.
4057 J. H. Lake. Propelling ships and vessels.
4061 W. Skinner, J. Farquharson, & D. W. Lane. Ship telegraph.
4074 F. Doering. Evaporating sea water.
4096 J. Holt. Lubricators.
4099 G. Allibon. Marine steam engines.
4114 R. H. Twigg. Engines and pumps.
4117 J. Westley. Valves for steam, water, or other fluids.
4129 J. P. Dille. Rotary engines.
4133 Fairweather (G. H. Babock and The Babock & Wilcox Co.). Steam boilers.
4134 Fairweather (N. W. Pratt and The Babock & Wilcox Co.). Steam generators.
4143 C. T. Colebrook. Rotary pumps.
4167 H. Jack. Valve gear.
4173 E. Braubach. Steering apparatus for ships.
4185 J. A. Wade & J. Cherry. Rotary engines.
4199 J. Fielding. Slide valve and gear.
4238 D. Johnston. Diminishing corrosion of screw propeller blades.
4249 S. Alley. In ships' pumps.
4251 J. McIntyre. Armour for ships of war.
4252 W. & T. Wills. Valve gear.
4257 Thompson (E. & G. A. Waters). Preserving life at sea.
4262 J. Edge. Mounting horizontal steam boilers.
4263 Walsh (M. Schneider). Lubricators.
4303 Clark (G. W. Appleby). Compound valve.
4381 J. Blake. Steam generators.
4395 H. Wilson. Low water alarms for steam boilers.
4404 M. Watson. Arresting gear for pumping engines.
4407 J. Fielding. Rotary motor.
4409 J. & D. Paterson. Steam engines.
4410 A. F. Barth. Vessels.
4411 J. Wright. Self-righting shore life-boat.
4412 V. Willis. Valves for air and other fluids.
4428 C. Boyce. Swivel shackle for ships' anchors.
4456 C. Heirons. Boilers.
4465 J. Barrett. Propelling boats.
4482 G. Lewis. Expanding engine tubes.
4483 N. W. Curtis. Motive power engines.
4505 S. Z. de Farranti. Steam and other engines.
4511 W. Welch. Propellers for ships.
4517 G. Wilson. Filtering.
4518 G. J. Scott & J. King. Compound marine steam engines.
4533 E. Wimshurst. Steam engine for raising ships' anchors.
4543 Reddie (W. Craig). Circulating water in steam boilers.
4544 Newton (J. W. A., G. F., A. G., & E. A. McAdams). Marine brakes for vessels.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

March 21th, 1885.

Barker, J.	1C	Snderland
Barr, H. D......	1C	Glasgow
Carr, R. G......	2C	London
Craggs, W.	1C	W H'pool
Crammond, A. ..	1C	N Shields
Dalgarno, W....	2C	Liverpool
Evith, W.	2C	Glasgow
Farrow, A.......	2C	Hull
Gray, C.........	1C	Liverpool
Hedley, W......	1C	Snderland
Huntley, G.	1C	,,
Keeys, E.	2C	W H'pool
Lancaster, E.....	1C	Liverpool
Morley, F. L....	1C	Hull
McCarthy, C....	2C	Liverpool
McKinnon, J. ..	2C	Glasgow
Mills, W. B.	2C	Snderland
Minto, J. C.	2C	W H'pool
Mitchell, A.	2C	Aberdeen
Morley, W. N...	2C	Hull
Munro, R. S.....	1C	Glasgow
Owen, W.	2C	Liverpool
Pattison, J.	2C	W H'pool
Pittrie, R.	2C	Aberdeen
Raine, A. T.....	1C	Snderland
Robinson, W. W.	2C	W H'pool
Robinson, C.	2C	Liverpool
Swinson, E.	1C	Snderland
Swinson, H.	1C	,,
Walker, W.	1C	,,
Watson, G.	2C	,,
Watson, J. M. ..	2C	Liverpool
Westbury, W. T.	1C	,,

March 28th, 1885.

Brazier, W.	1C	London
Cook, J. H......	2C	N Shields
Corry, W.	1C	,,
Galloway, R. M.	1C	,,
Greig, W.	2C	Leith
Hall, A.........	2C	,,
Harris, R. J.....	1C	London
Hastwell, H.....	2C	N Shields
Johnston, W. H.	2C	Dundee
Kilgour, W.	1C	London
Leitch, J.	1C	Liverpool
Mather, J. S....	1C	N Shields
McConachie, J.K.	1C	Sthmpton
MacFarlane, D..	1C	Liverpool
McOmbie, G.....	2C	N Shields
Metzger, J. M...	1C	Liverpool
Morgan, J. O. ..	2C	N Shields
Muir, J.........	2C	,,
Newcombe, R. ..	1C	Liverpool
Pill, W. H......	1C	,,
Randall, J. W...	1C	London
Shapter, T.......	2C	Plymouth
Sharp, H. W....	2C	N Shields
Sim, J. M.......	1C	,,
Tennant, W.....	2C	Liverpool
Thompson, J....	1C	N Shields
Watts, J. P.	2C	London
Young, J.	1C	Dundee

April 4th, 1885.

Atkinson	2C	Liverpool
Colville, J.......	2C	London
Cunningham, R.	2C	Glasgow
Fraser, Jos.	1C	,,
Fraser, Jno.	1C	,,
Gallie, T.	2C	Glasgow
Gavin, J.	2C	,,
Gibson, J.	2C	,,
Goodwin, W....	2C	,,
Lewis, A.	2C	Liverpool
McFarlane, N. ..	2C	Glasgow
M'Climent, R. J.	2C	,,
M'Eachern, D...	1C	,,
M'Quarrie, J. ..	2C	,,
M'Queen, J.	2C	Liverpool
Morison, T. A. ..	2C	Glasgow
Murdoch, W.....	2C	,,
Page, W. T.	2C	Liverpool
Renfrew, A.	2C	Glasgow
Ritson, R. C.....	1C	Liverpool
Ross, H. J......	2C	Glasgow
Scott, G. W.	1C	,,
Shepherd, H.....	1C	London
Sinclair, A.	2C	,,
Theyer, S. H....	1C	,,
Thomson, A.....	1C	Liverpool
Trew, J. B......	1C	London
Wallace, R.	1C	Glasgow
Wilson, T.	2C	,,

April 11th, 1885.

Anderson, C.....	2C	Greenock
Atkins, W......	2C	N Shields
Bengtsson, A. S.	2C	Greenock
Bickerton, R.....	1C	N Shields
Bird, T.........	2C	,,
Boleyn, T.	1C	Leith
Caines, C.	2C	London
Campbell, A.....	2C	Greenock
Charles, L.......	1C	Liverpool
Clark, R. A.	2C	Leith
Coutts, J.	1C	Liverpool
Coutts, W.......	2C	London
Cunning, T.	2C	Glasgow
Duncan, W.	1C	Aberdeen
Fairbairn, S.A.C.	1C	London
Feggeter, T.....	1C	Leith
Ferguson, J. H..	2C	London
Gibb, W........	2C	Leith
Gillespie, J.	2C	,,
Gowans, T......	1C	Liverpool
Kirkwood, J.....	1C	Leith
Laming, H. J. ..	2C	London
Linquist, O. W.	2C	,,
Manthorp, E. ..	2C	,,
Murray, T......	2C	,,
Nielsen, O. C. ..	2C	Greenock
Ould, J. G.	2C	London
Robertson, C. E.	1C	Leith
Thomas, J. J....	2C	Plymouth
Thomas, J. L. ..	1C	Liverpool
Wagstaff, W. ..	2C	London
Warren, W.	2C	,,
Watson, B. F. ..	2C	,,
Whitey, J.......	1C	,,
Whittington	2C	N Shields
Williamson, J. ..	2C	Leith

The Marine Engineer.

LONDON, JUNE 1, 1885.

EDITORIAL NOTES.

WE see from Sir Thomas Brassey's speech in the House of Commons on Navy estimates, that the engineers of the commercial marine are likely to be asked to place their services at the disposal of their country for engagement in the Navy, as and when required. This at last shows, we think, the importance that is now being attached by Government Departments to naval engineers as a body. At one time, during the introduction of our present ironclad system into the Royal Navy, the Navy was entirely dependent upon the engineering profession at large for the supply of competent engineers to take charge of the very complicated machinery of their new vessels. At this time, as is well known, their position and footing was extremely unsatisfactory, and most of the engineers who so entered the Navy have since retired through disappointment, owing to their general want of recognition as on an equal footing with other naval officers. In spite of the Government having devoted a great deal of attention, time, and money to a scheme for the education of marine engineering students, which has now been in full operation for many years, it appears likely that they would be very glad, in times of emergency, to draw upon the commercial marine engineers to supplement the services of the permanent staff, which may have been educated and prepared in a more formal and precise manner. This is quite in accordance with the usual system of our country, to restrict any permanent fighting staff, either on land or at sea, to the lowest possible figure in times of peace, and at the same time to avail itself of the well-known Anglo-Saxon spirit of combativeness, in order to have a large trained reserve, upon which it might call at short notice in any case of emergency. Some little information may be of use to the members of the commercial marine, should such a proposition be seriously made to them as to engagement in the Navy. The rank of engineers in the Navy at the present time is, assistant engineer, engineer, chief engineer, inspector of machinery, and chief inspector; and their respective relative rank is, sub-lieutenant, lieutenant, commander, and captain. As an engineer does not rank with the lieutenant until he has been eight years in service, all engineers, and of course, assistant engineers, joining the Navy, would find themselves below the rank of lieutenant and not entitled to a cabin or special accommodation beyond that of a hammock, a common bath room, and a mess berth. The suggestion also that the Royal Navy Reserve engineers rank, like other branches of the Reserve service, with, but after, the respective ranks in the permanent Navy, would press, on occasion, very hardly upon a member of the Reserve. For instance, an engineer of the Reserve in charge of a watch with an assistant of the permanent staff under him, would, should the assistant be promoted as full engineer, become the junior to the lately promoted assistant, as the latter would now rank before a similar rank in the Reserve. We do not doubt, however, that with all these drawbacks a considerable number of the engineers of the commercial marine would feel disposed, for the mere fun of the thing, and for the chance of seeing hard knocks at some future period, to take an opportunity of joining the Royal Navy Reserve, were such formally offered to them with anything like reasonable inducements.

Now that iron and steel hulls have entirely superseded the old wooden structures, both for commercial and naval purposes, it is not surprising that enterprising boat builders are devoting their attention to the substitution of the ordinary wooden ship and life boats by those made of metal. The drawbacks attending the construction of such boats in timber are obvious, namely, that they are always liable to open at the seams, and become unseaworthy in dry weather, and thus be possibly unserviceable at the moment of greatest need. Moreover, it is not difficult to start a plank in such a boat by a comparatively slight blow; and it is frequently the case that the boats are staved in in rough weather alongside the vessel before ever they can be pushed off, and they are also liable to accidental staving in by the wreckage of spars or other deck material which may have broken loose in rough weather. Galvanized iron has been tried for this purpose. This has been found too brittle, on account of the thinness of the material necessary, to stand ordinary rough usage. It is well known, however, that metallurgical processes have improved the quality of mild steel, particularly that known as Siemens steel, and that this can now be produced with a ductility, toughness, and strength that render it infinitely superior to iron for ship construction. We hear that a firm of boat builders is very successfully adapting this material, galvanised, to the construction of life boats and other ship boats. The material is of such extreme ductility

that it may be bent into shape cold, and may be bulged and knocked about to any extent without actual fracture to the plates. Strong wales are worked inside and outside, at the upper edge of the shear strake, thwarts being fitted to suit the size of the boat. Boats can be made much lighter than in ordinary timber, and they are very much stronger in proportion. Being galvanised they are not affected by exposure to weather, and, consequently, all is watertight and ready for immediate service. This sounds to us like a very good idea, and a natural consequence to the general adaptation of iron and steel in the construction of ships' hulls.

Much attention is now being devoted by all Governments to the development and capabilities of torpedo boat and launch services. We have already stated to our readers that we think that this would prove a very remunerative market for individual enterprise on the part of boat builders, as there is no doubt still great room for improvement in suiting torpedo launches and boats for their peculiar services; and the demand is likely to prove more than the limited number of firms that are already engaged in this market would be able to supply. We think, however, that some foreign Governments are wasting their time, money, and attention on a wrong tack. We hear that a Russian inventor has perfected a torpedo launch, to be driven by electrical accumulators and a motor, which is to be capable of maintaining a speed of 20 knots an hour for five hours. We also hear that a foreign Government, probably the same, is in treaty with a well known electrical company upon the Thames to supply a torpedo launch to be driven by electricity at a high speed. With the acquaintance that the scientific world at present has with regard to the relative weight and power developed by accumulators or other electrical batteries, which must necessarily be carried on board torpedo launches to develop the requisite power, we do not think that electricity, for many years to come, if ever, is likely to be able to compete with steam power for the development of a motive power or speed, where the weight of the appliances that have to be used and carried for the purpose is of any importance, as would essentially be the case with torpedo launches or other vessels. Silence in working, however, may in some instances counterbalance this objection, as also complete immunity from visible vapours or smoke, and from the necessity of a smoke stack.

In continuance of our remarks in a former issue, upon the large number of propeller shafts that are broken from time to time, particularly in our commercial marine, we would remark that our readers, under whose notice such accidents must frequently occur, could much assist the profession at large by offering data as to the conditions and circumstances of such breakdowns, and the remedies applied. A point which is seldom referred to, and yet may be of most vital importance, is the age of such shafts as may from time to time come to grief. It is a well known fact that the tendency in locomotive cranks to break increases with the number of miles they have run, so that in our railway practice there is a recognised mileage as approximately measuring the life of an ordinary railway crank. The conditions determining fracture from constant use, we have already referred to in our former issue, as arising from a change in the molecular structure of fibrous wrought iron when subject to continuous variable strain or jar. The constant jarring shocks, to which locomotive axles are subject, from travelling over a metal road, are absent in the case of the marine propeller shaft; but it is probable that the constant variation in the tortional and transverse strains, to which such a shaft is subjected, will, in the long run, produce an equally disastrous effect in change of structure. There is little doubt that in the long hulls of the sea-going liners, a very considerable amount of hogging and wringing takes place throughout the hull, in all of which movements the propeller shaft must take part, where it is of any considerable length, since the bearing blocks of propeller shafts are usually rigidly attached to the frame of the hull. The absolute deflection of a long shaft so produced might not in itself be to so great an extent as to cause dangerous transverse breaking strain; but it must be borne in mind that the conditions are very different when a shaft, so deflected, is obliged to rotate at the same time. This would cause a series of alternate bendings backwards and forwards most likely to prove destructive before long to any material. It is obvious that this particular class of strain would exist to a minimum extent in those vessels with the shortest lengths of propeller shafts—that is, where the engines are nearest to the propeller; and in those vessels with the long length of propeller shaft and with comparatively lightly-built hulls, this deflecting tendency would probably be at its maximum. If, then, seagoing engineers were to bear these points in mind in the course of their experience of such breakdowns, they might, by co-operation, accumulate a quantity of information that would lead to specific conclusions as to the most destructive cause, tending to produce a breaking of propeller shafts, and to methods of prevention.

PENETRABLE IRONCLADS.

So long as doctors continue to disagree in their diagnosis and treatment of human disorders, so long may we expect other professors and "medicine men" in all branches of science to have different opinions regarding most subjects which puzzle the common herd.

And a moment's reflection will convince us that this failure in agreement is not unnatural; but if anybody thinks it is, he must, at least, admit that it is not uncommon.

During the last month, the pages of the *Times* and other newspapers have been much occupied by that all-engrossing and truly important subject, "The Navy," and, in the former newspaper, learned disputants and critics have freely ventilated their opinions on certain technical points connected with our most valuable and recent ironclads.

It was unfortunate that at such a crisis in our foreign relations this question should have cropped up, and especially that men like Sir Edward Reed and Mr. White—both of them constructors of eminence and experience—did not, long ago, bring their arguments before the public, and before the ships were built; for ironclads, costing half a million of money, and occupying three years in construction, are very different weapons to a policeman's club, which can be turned out of a factory for nothing, and at the word of command. In opposition to the opinions of Sir Edward Reed, and many officers of great naval experience; is not only Mr. White, but a committee of gentlemen appointed by the Admiralty to specially consider and advise upon the great question of the efficiency of ships like the *Colossus* and the *Inflexible*. These experts are, Dr. Woolley, Mr. G. Rendell, Sir James Hope, and Mr. Froude; and they have expressed a "favourable opinion" of the fighting and staying powers of the above ships. It is said that this Committee has had the benefit, before arriving at any verdict, of a great mass of professional evidence; and that they have advised the Admiralty that the *Colossus* and her sister ship, are quite able to go into any action against any two of the most powerful ships of Italy or France. Such a verdict, coming from such judges, should send patriotic Britons to bed every night with a mind measurably free from cares—were it not for an unfortunate lurking suspicion that Her Majesty's advisers are not always infallible, and that there may possibly be, also, some truth in the contentions of the other side. The dangers of water-logging, which, of themselves, would compel such vessels to withdraw from an action, if the enemy gave them the opportunity, are certainly great, and have been much enlarged upon by Sir Edward Reed and many naval experts. And when we come to consider what great damage modern artillery can do to thin plating, and how heavy, elongated bolts, thrown from 100-ton guns, would rip and tear away all such honeycomb armament as the cellular method of protection, it is difficult, indeed, to help thinking that Sir E. Reed and his backers, are not in error. This cellular system, constructed of inch-plating—which is probably as thick as can be conveniently worked—is all very well for giving buoyancy to damaged sections, but it will never stop heavy shot: not even if packed with the most buoyant and shot-resisting material.

From the accounts we have of the enormous penetrative power of the largest shot, and the reports of damage from naval officers who were before Alexandria, it would be vain indeed to expect much from this method of backing, or protecting, thin plating.

Then, as to the vital question of the stability of the citadel, or midship section—with its heavily armoured sides, and ponderous guns, standing so much above the centre of gravity—after the ends are pierced, and the vessel's trim dangerously affected by the encroaching water; whatever experts may think, and however the trial of models may point, the perfect solution of such a problem can only be secured by a thorough practical test, carried out in the ever-changing and shifting seas of the open Channel. In reading the report of the Council, one cannot help being struck by the apparent feeling of doubt, and indecision, which runs through the whole fantastic wording of it; and what, also, has anything but a reassuring influence, is the laboured construction of their sentences, in taking especial care to leave a loop-hole for escape.

What is the good of these learned experts informing the public or the Admiralty, in regard to this vital question, that the chances of the ends being water-logged "are not likely to happen very early in an engagement"? Are they likely to know how many ships are going to attack such vessels when they go into an engagement, and what sort of guns they will carry? What the country wants to know, and what the Admiralty should have demanded from them, is an answer, yes or no, to this question; "Are they ships, upon which the safety and honour of the nation may depend with unbounded faith; and will they, the *Colossus* and *Inflexible*, stand up before any form of the great warships of European Powers?" This answer has not been given, and it is difficult to see how it can be given, for one lucky shot would probably go right through such unprotected ends, or at least tear away 40 ft. of skin plating, and leave as many large cells full of water, which would not only affect the vessel's trim, but her speed, very materially, as much in consequence of being out of trim, as to increased resistance and friction.

The fact is, no professional man can read the report of the Council, without having his previous doubts very much increased, and his faith in such advisers disagreeably affected.

It is misleading in the extreme, surely, for professional men to talk, through such an important question, about "naval actions nowadays soon coming to an end," and ironclad encounters being "short and sharp." Naval actions, and single fights between individual ships, will yet be what they always were, and that is, short or long according to the individual strength, and ability, and sustaining powers, of the combatants.

The conditions affecting such warfare will remain much as they always were, whether the vessels engaged are ironclads, or walls of oak. That ship which first has 20 or 40 ft. of her side torn away, and finds it necessary, in consequence, to withdraw from action, and to steam away to some far-off, or even handy harbour for repairs, is the ship, above all others, which will bring about disaster to her owners, and to her country. The ship or fleet which can stand bravely up to fight a battle against superior numbers on Monday, all day, and which is so impenetrable and seaworthy, as to be in a condition to offer battle on Tuesday morning at the first streak of dawn, is the ship, or fleet which will command the sea, and infallibly maintain the foundations of empire.

Some of the shot from the only partially heavy guns at Alexandria, made holes in the sides of our ships measuring 10 ft. by 4 ft.; and if such weapons would commit this havoc, what may we not expect from some of the guns which European nations are getting ready to send to sea? If an Egyptian gun rips away 40 superficial feet of iron surface, upon which an ironclad depends for her speed, her stability, and, in short, her actual safety—if one single shot will do all this—it may well be asked, what is going to happen when these thinly-protected ends—these "soft ends," as Admiral Wilson has well named them—have been subjected to the crucial test of a two hours' engagement, against as many 80-ton guns? The Committee of Experts have been careful to say in their report, that the ships in question would not probably suffer a "complete penetration" in a given time; but they ought to be aware that even a partial penetration, would be sufficient to bring about exactly such consequences as Sir E. Reed and other critics have feared. There are possibly few naval commanders who would keep such vessels before the enemy long enough to be completely penetrated, if they knew what the consequences of such damage would be, or if even they suspected that it would render their charges either unmanageable or top-heavy.

It surely does not require very much sagacity or technical knowledge to understand that guns which will penetrate 21 in. of steel-faced armour, will make short work indeed, of all kinds of cellular protection, however ingeniously it may be constructed, and however carefully packed with the most approved of water-excluding substance. If steel-faced armour, so thick, has not been penetrated already, there is every reason to suppose that before a very few years are over our heads, guns will be afloat, capable of such penetration. The *Esmeralda*, although at present useless from having her boilers burned, by certain changes in the engine-room will soon be again in working condition, and with her 25-ton guns, be capable of penetrating 21 in. of iron. The ship which can preserve a whole and impenetrable skin in a naval action, if only for half an hour longer than her opponent, has overwhelming advantages, both in steering qualities and in speed, against another which, even though she may be able to keep the sea, has her skin-plating torn away, and her steerage and steaming reduced from those high standards which have been declared to be so essential to success. Surely not much professional acumen is necessary to make this assumption very clear to all naval critics. A dozen fairly good shots fired at the *Inflexible* from some heavy gun, and by a man who knew what he was about, would probably develop the following conditions. A jagged hole along the break of the bow, and about the water line, 12 ft. in length, and from 3 to 4 ft. broad. Another

a little abaft it of same dimensions. Two such enormous rents, running into each other on the same side of the ship, but abaft the citadel, or midship section, and in that corresponding part of her which has no armoured protection, further than some flimsy 3 in. plates, to wit, her after unarmoured ends, would, certainly, affect her steaming, her steerage, and her buoyancy. If a possible French or Russian commander set himself to work to destroy the unarmoured portions of that ship, he would probably begin in this way, by attacking one side only, and by ploughing up her thin plates and destroying the cells, which alone could give her that buoyancy and support against either a dangerously strong list, or it might be an actual capsize. Such shot rents, jagged and torn as they would be, would infallibly bring down her speed by a good knot or more, and dangerously interfere with her steerage. How the Committee, presided over by Admiral Sir James Hope, can deliberately believe that such very simple, but nearly inevitable results from half an hour's close action, are "not likely to happen very early in an engagement," or that such assumed damage "is in a very high degree improbable, even in an engagement protracted to any extent which can be reasonably anticipated," is one of those things which occasionally puzzle less eminent men.

No attempt is being made here to champion the cause of any particular person, and as for Sir Edward Reed or Lord Henry Lennox, they are fully competent, along with other experts and naval officers of eminence, to explain their views on this important question. If it be true, as numerous speakers have declared, that Sir Edward Reed has repeatedly been asked to give his reasons, and explain his objections, before a competent tribunal, and that he has always persistently declined to do this, and has rather "sought the columns of a newspaper, where he could expatiate before a public who are ignorant of his technicalities," such is to be regretted, for whatever he could say would all be in the nature of assumptions and suppositions; but they would be the expressions of a naval constructor who probably knows as much about ironclads and their powers to resist attack, as any man connected with shipbuilding. Still, there are plenty of people in the country who are neither naval constructors, admirals of long experience, professors of abstruse sciences, nor "distinguished students of novel, graphic, and other eminently practical processes" in ironclad construction, who can form a pretty accurate opinion of the damage likely to happen to the unarmoured ends of the *Colossus*, if she falls in with an intelligent and determined enemy, carrying a couple, or perhaps four, 36-ton guns, which so many ships are now armed with. It is perfectly absurd to suppose that it should require, either single individuals or committees of experts, to enlighten the country on such a question, when all the world knows that the little Republic of Chili, along with other third-rate naval Powers, can send their projectiles through 21 in of armour.

What the Admiralty have now to consider, and that as quickly as they can, is the readiest way of putting a stout belt of armour round all these soft-ended ships. Now is the time, when the money has been voted, and the country has had a wholesome scare, to get on with this work; for as surely as night follows day will disaster overtake us, if ever we go into action against an enemy with all-round armour. Our unprotected ends will be battered to pieces, and our ships water-logged, useless, and knocked into a cocked hat, before they have been two hours in battle. We shall have the delightful spectacle of seeing one with a list of 20° to starboard, and with such an extreme angle of inclination thereby, that her guns will not revolve, nor her crew obtain a footing upon her slanting decks. There will be another, which has only suffered at *one* end—forward—and she is so gone down by the head in consequence, that her speed of 16 knots has been reduced to five, and her steering power become impossible. Other two may possibly have turned over and gone to the bottom, along with the £600,000 in gold which had been put into them, taking with them their helpless but noble crews. Four more will possibly be in port repairing damages, at a cost nearly equivalent to their building, which will bring their value up to £800,000 each, and only ready to take the sea when our commercial fleets have been captured, and the "meteor flag" has disappeared.

Cheap ships are the nastiest and most dangerous of all cheap things, and about as bad a speculation as any body of men had anything to do with. But cheap ironclads, which are the bulwarks of our existence as a maritime nation, will as assuredly bring us to ruin, as the very maddest of all mad investments. We are the only nation which has had the temerity to embark in this class of ship, and the only nation also which, in the event of a naval disaster, has everything to lose—prestige, honour, supremacy, glorious traditions, and even life; which last loss, by the way, would be infinitely preferable to many of the former. We have been driven into these cheap and dangerous ships, less by want of common sense than by false ideas of economy, which it is indeed impossible to understand how those in authority, and responsible for the safety of the country, could have even suffered themselves to have been beguiled into. If even our neighbours had embarked in such schemes, we, from our great interest at stake, should have held aloof from them; and the least particle of doubt in this direction should have been enough for us, when we reflected upon the consequences of a lost battle, or naval disaster of any kind.

It is all very well to point to torpedoes, and say, some day your costly ship will be sent flying into the air; but while recognising just as much truth as there may be in such a remark, we must still take care to be stronger than our friends. We might very justly demand to be twice as strong as any two European Powers, for what are their responsibilities compared with ours? If France, who has absolutely no merchant ships to protect, and who could feed her population without ships, if she is determined to spend her money in such weapons, so must we; and they should rather be doubly as strong, than infinitely weaker.

If our neighbours determine upon 2 ft. of all-round armour, so must we; aye, even to 3 ft., and with just double their number of ships. It is a necessity which is forced upon us, independent of all the assumed power of future torpedoes, to defend or to destroy.

But with the resolution of being ready to fight any two European navies, we are not absolutely bound to copy them too closely, either in the size or types of their ships. If three feet of armour cannot be carried, except by a great floating island of iron, let us make up in numbers, what we have not in actual strength of side. Naval experts have pronounced the *Polyphemus*, though rather too small, to be still a very formidable vessel; and if we determine upon ships like her, which cost but one-fifth that of a great ironclad, we can put five of them afloat for every one of the thick-sided vessels of our friends. Give them each one heavy gun, the highest possible speed, and a powerful and substantial ram; and let them use it, and depend more upon it than upon any kind of artillery, which, however powerful it may be, amounts to little more than pea shooting, when compared with the certainty and overwhelming results of ramming.

THE JAMES WATT DOCK, GREENOCK.

ON May 1st the last copestone of the James Watt Dock at Greenock was laid by Provost Wilson at the north-east corner of the dock, and immediately thereafter the water was let into the dock by Mr. John Scott, shipbuilder, and deputy-chairman of the Greenock Harbour Trust. The work has already taken nearly seven years to complete. The works will have a frontage to the River Clyde of about one and a quarter mile, and comprise the Western Tidal Harbour, the James Watt Dock, the Northern Tidal Harbour, the Graving Docks, and the Eastern or Great Tidal Harbour. The Garvel Graving Dock was commenced in 1870, and opened in April, 1874. The temporary piers and entrance channel-way, leading from the River Clyde to the dock, were also constructed at the same time. The water area of the Western Tidal Harbour will amount to seven acres when completed. At present a portion only of this harbour is being constructed, having a length of quays of 1,150 ft., with a depth of water of 35 ft. at high water, or 25 ft. at low water. The length of the James Watt Dock—the first sod of which was cut by Provost Lyle on the 1st August, 1878, and the foundation stone laid by Provost Campbell on the 6th of August, 1881—is 2,000 ft., the breadth, for about one-half of its length, 300 ft., the other half being increased to 350 ft., where a jetty of 800 ft. in length and 50 ft. in width has been constructed. The depth of water in the dock is 32 ft., a depth, it is anticipated, sufficient to accommodate the largest class of vessels ever likely to be built. There are two entrances to the dock—one from the Western Tidal Harbour, and the other from the Great Harbour. Each is 75 ft. in width, with 32 ft. of water on the cill at high water ordinary spring tides. The water area of the dock is 14¼ acres, and the length of quays 6,400 ft. On the sites of the James Watt Dock and the Western Tidal Harbour the original surface of the ground was about 7 ft. above the finished level of the quays, so that the average depth of excavation has been 47 ft. The materials excavated consisted chiefly of sandstone rock, and clay full of boulders, many of which were more

than five tons weight. A special feature in the execution of these works is the great extent to which mechanical power was substituted for manual labour. For the purpose of excavating the clay, steam diggers or navvies were employed capable of doing the work of hundreds of men. The best of the stone from the excavations was used in the rough ashlar or "sneckled" rubble of the quay walls. Large quantities of the materials were deposited on the site of the connection with the Caledonian Railway at Cappielow, on the south side of the turnpike road, and at the timber ponds on the south side at Cappielow, which latter forms the south quay of the Great Harbour. The river embankment was also formed with these materials. By the construction of the river embankment a place for the deposit of the excavations was obtained, otherwise the materials would have had to be taken to and deposited in Loch Long, at a cost of about £70,000, whereas by this mode of depositing in the embankment, at a cost of about £20,000, a large tidal harbour is now all but formed, and a saving of about £50,000 effected. The area over which the large harbour is being constructed has been obtained from the Crown at a nominal sum. This splendid harbour, 4,000 ft. in length by 700 ft. in width, will, when completed, have a depth of 28 ft. at low water, and 38 ft. at high tide. The southern embankment is now completed up to the Clyde Pottery, and tenders have been called for by the Harbour Trustees for a supply of stone to complete the embankment, so as to enable the Glasgow and South-Western Railway Company to have a connection with the James Watt Dock whenever it is ready for traffic. The Northern Tidal Harbour, when completed, will have a water area of seven acres, with a length of 2,600 ft. of quay walls, having a depth of 35 ft. at high water or 25 ft. at low water. The walls of the pierhead of the Western Tidal Harbour have been founded at 28 ft. below low water in a trench dredged out of hard boulder clay. The Tidal Harbour and dock walls have curved toes of brickwork in Portland cement compo, founded from 2 ft. to 6 ft. 6 in. below the bottom of the dock; from the top of these up to about low water-mark the walls are faced with heavy "sneckled" rubble or rough ashlar, pick dressed on the face, and of a quality which we believe has never been surpassed in similar works. At each entrance to the wet dock one of Mr. Kiniple's patent caissons will be floated into position in the course of a day or two to retain the water in the dock. These caissons have been constructed in the dock by Messrs. Kincaid & Co., Clyde Foundry, Greenock, and the lowering or folding bridges on the top of the caisson provide railway and roadway communication across the entrance, in lieu of, as is usually the case, a floating caisson or double-lock gates and a swing bridge to each entrance. By the adoption of Mr. Kiniple's caissons a considerable saving in the length and cost of the entrances is effected, and as the cost of double gates is exactly the same as the cost of a caisson, there is the saving of the entire cost of a swing bridge with its expensive foundations and opening machinery, while the quay is not in any way obstructed by a swing bridge and pit; and further, with these caissons a dock may be opened or closed in a few minutes at any time of the tide and in almost any sea or weather, or during a considerable current through the entrance. A sub-way passes under the western entrance, so that if the caisson is open one can pass from one side of the dock to the other conveniently. At the bottom of the sub-way, and nearly 60 ft. below the surface of the earth, there is a hydraulic pump with starting valves at coping level. The contract drawings and specifications for these were prepared by Mr. W. R. Kiniple, M. Inst. C.E., consulting and chief engineer to the Greenock Harbour Trustees, and the works have been carried out under his superintendence by Mr. John Waddell, contractor, Edinburgh. The works will cost, including the Garvel Graving Dock, land, sheds, warehouses, cranes, machinery, &c., over £800,000. The warehouses, sheds, and covered way are now in course of construction on the south side of the dock by Messrs. J. & R. Houston, of the Cartsburn Foundry, whose contract is £27,500. The warehouse and shed accommodation f.r goods and cattle will be of the most ample and modern character, and the best appliances for loading and discharging vessels are being provided. Railway connection is being provided round the docks and into the warehouses and sheds from the Caledonian Railway, in connection with the London and North-Western Railway, and from the Glasgow and South-Western Railway, in connection with the Midland Railway.

One of the new torpedo boats, 115 ft. long, built by Messrs. J. I. Thornycroft & Co., has attained, on a three hours' trial, a speed of 19·74 knots an hour in a fresh breeze and lumpy sea. At 11 knots the consumption was 1 cwt. an hour.

THE FUTURE OF NAVAL WARFARE.

An Abstract of a Lecture by H. Middleton.

(*Concluded from page* 35.)

And now let me say a few words about guns.

As late as 1854 the largest guns in the British Navy were cannon weighing from 2¼ to 4¾ tons, which burnt from 10 to 16 lbs. of powder to propel their 32 to 68 lb. projectiles. Moreover, the largest bursting charges used in shells of that date were only from ½ to 5 lbs. of powder. And yet, so deadly was the effect of these small shells upon ships' crews, that Brassey and Reed agree in asserting that their use compelled the abandonment of the unarmoured hull of that day, and the substitution of the armoured ones of the present time. Guns weighing 64, 80, 100 and 110 tons are now carried on shipboard. Some of these monster weapons discharge projectiles of nearly *half a ton* in weight, and consume "700 lbs. of powder in one charge."* But this is not all. The modern shells are loaded with from 30 to 40 lbs. of powder; and so vast is the amount of energy stored in their solid shot, that from their effects on the targets at Spezzia it was estimated that they were "capable of perforating 40 in. unbacked armour."† From this performance of solid shot, let us consider what is to be expected of the effect of modern shells. Unfortunately there is much uncertainty in this matter; for the Admiralty, probably fearing that a panic would be produced did the true destructiveness of shell, *when bursting in* armoured ships, become known, have quietly refused to subject any of the ironclads to such an ordeal. However, engineers and naval constructors know something about their probable effect, as the "War between the States" in America, and the war between Chili and Peru, &c., &c., furnish many facts in this connection. But further, let me tell you what a serious effect the firing of *her own guns* had upon the turret-ship *Neptune*. With regard to it a correspondent of the *Times* writes—"The concussion on the fighting deck below, however, was very great, and considerable damage was inflicted during the trial. The glass fell in showers, as was to be expected, but the situation became more serious when the upward rush of air from below to fill the vacuum produced on the weather deck by the explosion of the heavy charges, carried away the cover of the capstan head, and lifted the deck, in the wake of the capstan, bodily, to such an extent, that the staunchions were torn from their fastenings." . . . . "A panel in the chart house was smashed, the grating of one of the coaling scuttles was lifted from its place and carried away, and a cutter, which was resting on crutches on the port side of the hurricane deck, parted along the keel on both sides, and had one of its sides blown away outwardly," &c., &c. Now, such was the effect on the vessel produced by firing *her own guns!* and moreover those guns were only 38-ton guns (of 12½ in. calibre) and loaded with *but* 130 lbs. of powder, and an 800 lb. shot. Such, then, was a specimen of the performance of a ship bought by the Admiralty, because, forsooth, they considered her a valuable (?) addition to the Navy of Great Britain. And perhaps the *Neptune* is not very much worse ‡ than the vessels which they themselves have furnished forth to maintain the fighting strength and glorious ancient renown of Old England.

Under *such circumstances* we are not much surprised that a late Chief Constructor of the Navy writes:—"I never cease to be haunted with the fear that in the absence of satisfactory experiments, so arranged as to clear up the doubt, we may be all underrating—and very seriously underrating—the results of the bursting of explosive shells in the unprotected, and more or less inflammatory portions of ironclad ships." . . . . "Who shall say what will be the consequences of shot and shell, weighing some hundredweights each, and fired with half a hundredweight or a hundredweight of powder, tearing through the sides and decks of vessels, or some of them bursting between decks with 20 or 30 pounds of powder exploding at each discharge?" Truly it is a *terrible* responsibility the Admiralty are assuming in building ship after ship and ironclad after ironclad, when they *must know* in their *inmost souls* how *utterly inefficient such* vessels would prove when subjected to the dread ordeal of modern battle. Do they think that when we see our sailors slaughtered, and our

* *The National Review*.—Art. by Mr. W. H. Smith, M.P.

† Mr. Barnaby, as quoted in the *Times*.

‡ I believe the *Neptune* has been improved since bought, but I consider her and several other vessels still *so bad*, that their performance, *in war*, will (it is likely) hardly be better than that of the *Neptune*, *in peace*, which I have cited.

ships sunk, that they will be held to have done *their duty;* and that popular opinion will consider it to be—

" . . . to look on, and bid the valiant die"?

I conceive it is an utter waste of time, at this late day, to give lists of ironclads and repeat classifications of them and comparisons with those of other European Powers. For, as has been admirably expressed in the *Engineer*:—"All comparisons of naval strength must be misleading, as far as this country is concerned, if they are based solely on ironclad fleets, simply because ironclads are not the only weapons with which we could be attacked, nor are they the weapons from which we have the most to dread. If it could be shown to-morrow that England had twice as many ironclads—line-of-battle ships—twice as powerful as those of France, there would be hardly less cause for anxiety than we have now."

But the writer from whom I have quoted, while acknowledging *the danger*, does not appear (to me) to suggest a remedy *that is practicable*. To my mind the problem presented for solution is simply this:—A group of islands, with a population of some 36,000,000 of people, have to be fed in time of war to such an extent that rather more corn than would suffice to feed 20,000,000 continuously must be brought into the United Kingdom from over the sea. To bring this great amount of grain in unarmoured vessels protected by ironclads, is acknowledged by naval men *to be impossible*. And the only feasible way hitherto proposed by *savants* or sailors, of accomplishing the desired end, is by building an ironclad navy of such gigantic size and vast number of ships, that you can drive your enemies from the seas.

Let us examine this advice for a moment: History is said to be philosophy teaching by examples. If so, let us take a few lessons from her school.

In 1779, England had a navy *nearly four times* as great as that of France. From 1779 to 1804 war was constantly—if not continuously—waged between the two countries; and yet in spite of the *many brilliant* victories gained by the English, there never was a time when the French fleet could be said to have been entirely driven from the sea. There never was a time when that navy was so crippled as to be unable to sally forth from port when an opportunity appeared to present itself, or chance enabled it, either alone or allied with that of Spain, to sally forth for battle when it was considered that *superior numbers* would give the allies the victory.*

But let me take another and still stronger case: Let me tell you how a people who had no navy—only three or four fast cruisers—was yet able utterly to destroy the commerce of a country which possessed a numerous merchant marine and a powerful navy of wooden and iron vessels. In July, 1862, the *wooden* steamer *Alabama* of 900 tons burden and 300 H.P. (only), sailed from the Mersey. Shortly after she took in her guns and stores at the Bermudas † and hoisted the Confederate flag. In less than two years her commander—the ever famous Admiral Semmes—had all but swept the seas of the merchant marine of the United States!!! For, so great was the number of ships taken by him, that in terror of his name the Northern shipowners either laid up their vessels or sold them to foreigners. And now, the United States flag is hardly seen on the high seas, whereas in 1861 it flew from the peaks of a merchant fleet whose numbers were second to that of Great Britain alone. Such—such are the results of the *career of a cruiser*, and that of *the transference of trade to a neutral* flag!!! And yet Sir Thomas Brassey (a Civil Lord of the Admiralty) coolly contemplates such a condition of affairs, and informs his countrymen that, according to his opinion, "No amount of construction which the country would approve in time of peace would prevent the transfer, on the outbreak of war, of a large portion of your trade to a neutral flag, under the protection of which our supplies of food would be brought to us." ‡ I will not comment further on Brassey's words except to add that his account of matters hardly tallies with the boastful assertions of Mr. Childers in the House of Commons in 1874—to wit—that if at twenty-four hours notice we should be at war without an ally with the three principal maritime Powers, even allowing an ally to them, . . . within six months we should have complete command of the seas and have ruined our opponents' commerce. §

Byron tells us—

"A man must serve his time to every trade
Save censure—critics all are ready made"—

and that you may not cite the same for my discomfiture, I am now going to prove to you that *if I find fault, I can also find a remedy*.

That remedy is the construction of vessels *capable of moving under water*, and of carrying on submarine warfare.

At present the armoured ship (or ironclad) can do little against a well-armed sea battery. Indeed, almost all harbours, when properly fortified and bravely defended, can be said to be impregnable to the attacks of a fleet as now constituted. But if the assailing ships could pass under water, they would be able to "run the gauntlet" of the forts without the latter being able to fire a single effective shot in defence of the channel they were put up to protect. Indeed, a flotilla of such boats in the hands of a foreign foe would convert the English Channel into the *most dangerous frontier* that any European nation has to guard. In fact, such boats render the whole southern defences of England and Ireland *utterly* valueless.

Possibly, even in time of peace, the submarine boat will possess many advantages, to wit:

1st. Its cargo capacity is doubled (since no "free board" is required).

2nd. The danger from storms and delays from such are simply nothing.

3rd. The speed of communication by sea will be increased, while its regularity will be as great as that of our present railway trains.

However, it may be objected that the expense of working submarine engines would alone prevent their competition with the ordinary steam engine—from reasons of economy. But, be this as it may, they are certainly of immense value, if only used for a short time, in enabling corn ships to be submerged *temporarily* to elude the pursuit of ironclads or other war vessels. Hence England *could always be provisioned by such ships*.

Hitherto the inability of mathematicians and mechanicians to solve two problems:—

1st. The mechanics of flight in fluids,

2nd. The construction of a motor capable of working under water,

has precluded any advance being made in this new method of naval warfare. But as I have been able to give an approximate solution of the first problem, and a more or less imperfect—though yet practical—solution of the second, perhaps I may be permitted to speak on this subject.

I shall divide my remarks into four heads.

I. The submarine ships I have invented.

II. The manner of employing the same for the attack of modern war-vessels.

III. The manner of employing them for attacking coast defences.

IV. The manner of employing them for the destruction of submarine tunnels.

I. The Submarine Ship.

I have invented three forms of these, which can be considered conveniently as types of a class, which I designate as class (*a*), (*b*), and (*c*) respectively.

Class (*a*). The boats or ships of this form are intended for speed. Their general form is that of a very prolate spheroid. They are furnished with two fins and single (or double) screws at the stern. They simply fly under water as the Guillemot does (or as a bird flies in the air). The period of submersion varies with the size and design of the boat, how it is armed, armoured, &c., &c. This type of ship is intended for speed. The larger ones carry submarine guns; the smaller, torpedoes.

Class (*b*). The ships of this class are constructed for their carrying capacity and small depth of "draught" to fit them for attacking harbours, and being used as transports for troops and the munitions of war generally. Their shape is somewhat that of two segments of a sphere united at their bases. Speed is sacrificed to carrying capacity, and, moreover, they are capable of being submerged longer than boats of class (*a*). They have four fins and two screws.

Class (*c*). The third class are only intended to be used as torpedo launches, to be carried by fast cruisers, &c., &c. They are driven by electrical engines, and can only remain a limited time under water. They are armed with torpedoes alone; but, like the others, I am compelled by want of time to omit fuller descriptions of their various parts, &c., &c.

* The British Fleet was outnumbered at "Trafalgar," "St. Vincent," &c.

† I believe the guns were actually put on board when the vessel was some miles from shore, and her portholes were *afterwards* cut by the ship's carpenters.

‡ See the *National Review*, where Smith quotes Brassey to that effect.

§ See *National Review*, where Smith quotes Childers.

II. The Manner of Employing Submarine Ships for the purpose of Attacking modern Vessels of War.

The vessels of class (*a*) are the type by which operations on the high seas are to be performed. When cruising, ships of class (*a*) are constructed to steam about with their funnels and a small portion (only) of their hulls above water. (The accompanying sketch shows a ship of class (*a*) cruising.) Owing to the great

displacement of the vessel, its hull can be made extremely thick and strong. When the ship is to be taken "into action"—say for the purpose of attacking an ironclad—the funnels are withdrawn into the hull, and the latter closed up water-tight. Then the vessel's submarine engines are started, when the ship has been sunk some 10 or 15 ft. Usually this would be done when the submarine ship is some 2½ miles from the ship to be destroyed, and when the foe can be reached in a few minutes. When within a short distance of the doomed vessel, a percussion shell is fired from the submarine gun against her unprotected bottom, or a "buoyant torpedo" * is attached and exploded by electricity; but the particular method of attack would depend *upon many circumstances*, as the *size* of the *attacking* ship, the state of rest or motion of the foe, &c., &c. However, either method would produce such a rent in the ironclad's bottom, that no pumps in the world *could keep it afloat*; men, guns, all *must sink*.

Time prevents me from touching upon even the methods of protecting and preserving the submarine ships I have described when injured in action.

* * * * * *

III. The Manner of Employing Submarine Ships for Attacking Coast Defences.

Want of time compels me to omit this section, as likewise section IV. to wit:

IV. The Manner of Employing them for the Destruction of Submarine Tunnels, &c., &c.

And I find I must in haste close this abstract of my lecture by pointing out as briefly as possible some of the problems which had to be solved ere these submarine ships could be rendered practically applicable to the purpose of carrying on naval war beneath the surface of the sea.

1st. The circulatory apparatus of the ships—that is to say the way air is made to pass through "regenerators," &c., &c., so as to render it fit to be breathed over and over again by the crews of the same.

2nd. The method of producing the motive power, and the invention of the mechanism apertaining immediately thereto.

3rd. The locomotive machinery, which comprehends not only the screw engines, pumps, &c., &c., but also the mechanism to move the "fins," and in fact make them perform the motions indicated by the mathematical analysis of the mechanics of flight.

4th. The steering and guiding, or navigating machinery, including the apparatus for determining the depth at which, and the velocity with which, the vessel is moving at any assigned time, &c., &c.

5th. The armament—including under such head not only the guns and apparatus for loading, firing, &c., &c., under water, but also the supplementary torpedo arrangements and instruments for removing obstructions, submarine mines, &c., &c., in harbours.

I now conclude this short *resumé* of my lecture on "The Future of Naval Warfare," greatly regretting that want of space compels me to leave so much for the reader to conjecture as to the methods of employing these new specimens of naval architecture.

* This expression refers to an invention of my own.

The Turkish Government have ordered in France, says the *Army and Navy Gazette*, five torpedo boats 101 ft. long and 11·6 ft. broad. The speed is to be 20 knots an hour, and the torpedo discharge under water. The engines are to develop 550 I.H.P. Each boat is to be provided with two machine guns.

International Inventions Exhibition.

THE month that has now lapsed since the first opening of this Exhibition has made a vast difference in the completeness of the various exhibits and the general finish of the arrangements. There is hardly now a square yard of ground except in the Russian, and one or two of the other foreign annexes that is not occupied by some exhibit of interest. It is impossible to glance through the catalogue in the various classes comprised therein without feeling that every class of industrial manufacture is worthily illustrated, the whole exhibition thus forming a most valuable place of reference as to the position of inventions in any desired industry. In our own department of marine engineering, we find a most striking series of exhibits, immediately facing the entrance in the main gallery or middle court. We refer to the samples of artillery of all sizes, from small arms up to an 8-inch breech-loading Woolwich gun. This is built entirely of steel, and is a most magnificent piece of workmanship. The Royal Arsenal also shows a steel breech-loading field-piece, weighing 7 cwt. A new method also for the removal of cores from solid guns is illustrated here, in the form of what is called a trepanning bar. By this process the core may be cut out solidly, which of course may be made use of for various purposes as it is solid metal, whilst by the old process the core so removed in shavings would afterwards only have the value of scrap. The Royal Laboratory shows for comparison the ammunition of an old 68-pounder smooth bore gun, and a 12-in. breech-loading modern cartridge complete. The Royal Small Arms Factory contributes Nordenfelt machine guns with rifles and carbines, whilst the Royal Engineers' Establishment have a complete selection of submarine mining apparatus. A Whitehead torpedo with other adjuncts of the torpedo service are certain to attract much interest, whilst the Nordenfelt, Hotchkiss, and Maxim machine guns well represent this class of weapon. We shall hope in a later issue to give detailed illustrations and descriptions of these exhibits.

The South Eastern Railway Company endeavour to push their undertaking, the Channel Tunnel, by an interesting collection of models, including a section of the Straits of Dover and the course of the proposed tunnel. The boring machines which are also used in the excavation of the tunnel are also illustrated by models. Messrs. Clark & Stanfield are well represented by a large collection of drawings of hydraulic lifts, accumulators, floating docks, patent slips, camels for wreck raising, and other interesting details of their hydraulic work. Submarine enterprise is illustrated in its latest perfection by the Fleuss breathing dress, which, however, is exhibited as specially arranged to enable the wearer to enter a chamber or mine full of choke damp, fire damp, or smoke, or other noxious atmosphere. Railway plant forms a very important part of the exhibits in the middle court, Mr. Webb's large compound locomotive forming a most conspicuous exhibit in this group. There are several mechanical brakes for railways in this class all shown either by striking models or practical appliances.

Amongst the prime movers we notice Messrs. Maudslay, Sons and Field's exhibit of the four-cylinder compound engines, which they have fitted to the large vessels of the White Star Line, and the Compagnie Générale Trans-

atlantique. There are many different gas engines and steam engines, all of the most modern type, and of the latest improvements in valve-gear, and boilers, by which steam is being supplied to the engine driving the moving exhibits, which are themselves well worthy of attention, as being fitted up in a most perfect and complete manner. The Queen's Gate annex is occupied by a series of interesting models of war and merchant ships representing the department of naval architecture. There is a model here exhibited by the firm of Sir William Armstrong & Co., of Elswick, of the Chilian cruiser *Esmeralda*, which has already attracted attention as one of the most powerful and useful war vessels of her tonnage in the world. Gun-boats are also amply represented by the same firm, by models of the Chinese gun-boats built in 1881, which are considered some of the most powerful gun-boats afloat.

The Thames Iron Works show also a collection of models, of which the *Warrior* and the *Benbow*, two well-known ironclads, are the most interesting. Messrs. Laird Bros., of Birkenhead, show an interesting series of models, showing the progress in paddle-wheel steamers since 1840, and screw mail steamers since 1852. The Lords Commissioners of the Admiralty also show a large series of models showing the gradual change in the type of the ships in the Royal Navy. Messrs. Samuda Bros. with the *Riachuelo*, and Messrs. Yarrow & Co., with models of the stern-wheel steamers used on the Nile, form prominent exhibitors in this annex. Samples of life-boats, propellers, and crank-shafts, by Messrs. William Jessop & Sons, form items of interest to ship-builders. The rest of this annex is occupied by carriages, bicycles, and tricycles, which, though interesting to the users of those very popular conveyances, we shall not further refer to.

Hydraulic machinery is well represented in the west gallery by Messrs. Fielding & Platt, who show Tweddell's system of hydraulic rivetting, whilst the Hydraulic Engineering Co. have a very large collection of hydraulic capstans, cranes, accumulators, and other machine tools. Messrs. Easton & Anderson also show high-pressure air-compressing pumps for charging torpedoes, and the model of a patent hydraulic ferry-steamer for tidal rivers, and also parts of the lifts for the Mersey Tunnel railway, each of which lifts can raise from 80 to 100 people. An immense number of all the latest improvements in printing machinery is concentrated in the East Arcade, and at one of its extremities is to be seen the most modern electrical appliances. In this department the details are most interesting and numerous, though to a very great extent chiefly adapted to house and public lighting purposes. Many of these we shall have to deal with later on in detail. Incandescent lamps form one of the most important items of modern electrical manufacture, and are shown in great number by Mr. Swan, by Messrs. Woodhouse & Rawson, and the Anglo-American Brush Company and others. Batteries, both primary and secondary, are represented by the Holmes Burke Cells exhibited by Mr. March, and by the Electrical Power Storage Company. Dynamo machines are chiefly exhibited by Messrs. Siemens, the Anglo-American Brush Co., Messrs. Paterson & Cooper, and Messrs. R. E. Crompton & Co. After this hasty summary of some of the chief points of marine engineering interests at the Exhibition, we will now give our readers some more detailed information of some of the individual exhibits.

MESSRS. WILLIAM JESSOP & SONS, LIMITED.

This well-known firm have a very extensive exhibit of their steel castings, chiefly for marine purposes. The large steel manufacturers of this country have learned a very great deal in the last few years, and the large steel castings of the present day are very different to those of ten years ago; although large crank shafts and similar important parts of engines were cast then, they were far from being satisfactory; it was unusual for them to be quite sound, and though moderately soft in some parts they were often so hard in others that it was with difficulty that they could be machined; also when put to work they were uncertain, often all that could be desired, but at other times giving way from no apparent cause; it was usual also then to partly forge them, which added to the cost and risk of the ultimate result. Messrs. Jessop & Sons are noted for their present steel crucible castings, for which by their great experience and patient perseverance they have obtained a world-wide name; their castings are made from carefully selected material, and the castings poured with a considerable head. They show a 10 in. double crank shaft for a pair of marine engines, finished bright all over, and though we examined it carefully we could not detect any flaw or defect of any kind; it had not been forged at all but machined from the casting. They have also on their stand one of Turton's patent crank shafts, 15½ in. diameter, a four bladed cast steel propeller, a large connecting rod, stern-frames, rudders, and numerous other steel castings. Messrs. Jessop & Sons recently cast a large stern-frame for the new twin screw steamer for the London & North Western Railway Company's Holyhead trade; it weighed 13 tons, and was complete in one casting with the two bosses to carry the ends of the propeller shafts; a wooden full sized model of this stern-frame is an attractive feature in the grounds. They are also at present making the two struts to carry the screw shafts of H.M.S. *Benbow*, now building by the Thames Iron Works Company, Limited.

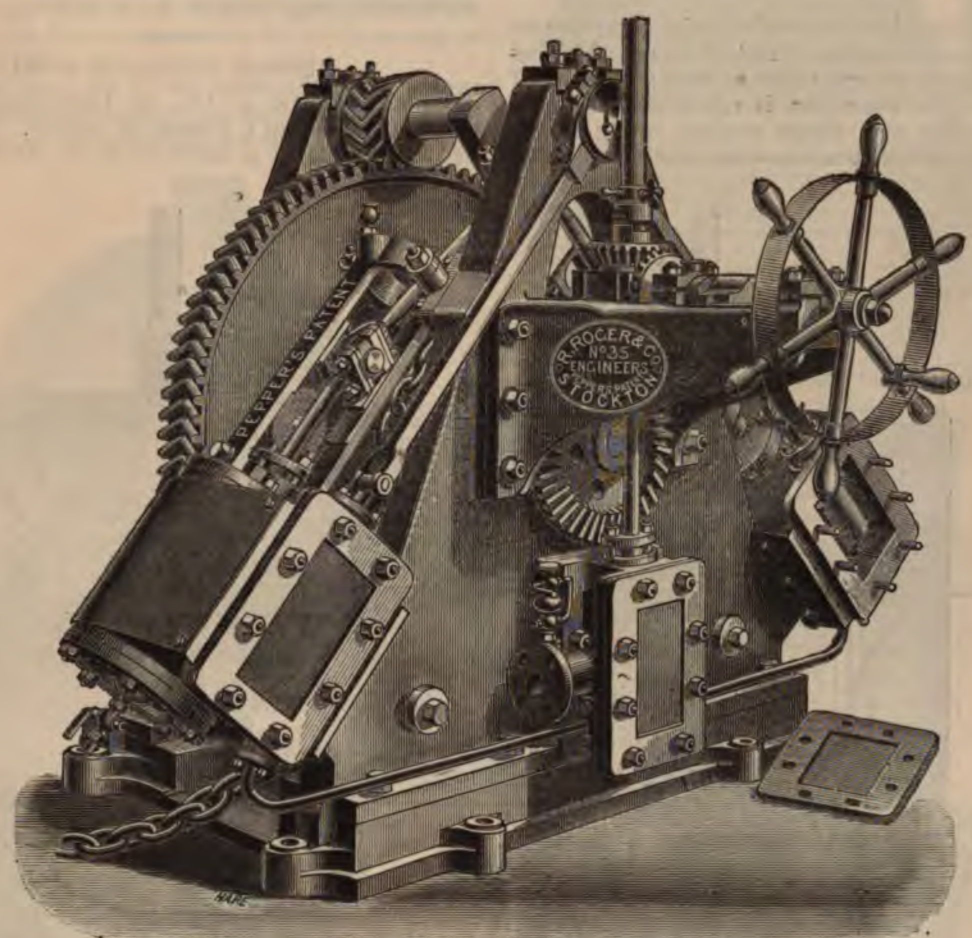
Messrs. Jessop & Sons also have a model of Hall & Verity's flexible screw shaft, in which, instead of rigid couplings between each length of shaft, a coupling is used which allows the different lengths to assume positions out of the straight, without any straining. When will some enterprising engineer cease to talk about the straining of a rigid screw shaft in a long ship, and try some method of accommodating it?

PEPPER'S STEAM STEERING GEAR.

Messrs. Robert Roger & Co., of Stockton-on-Tees, show a very interesting steam steering gear, designed by Mr. Pepper, who has had a considerable amount of experience in this class of machinery. It will be seen from the engraving that it forms a very compact arrangement, whilst every part of it can be readily got at, all the glands, working pins, and covers being unusually accessible. The chain barrel is driven directly by means of the helical spur wheel and pinion, which is, of course, much stronger and works more quietly than ordinary teeth. Like almost all steam steering gears the special feature in this is in the valve gear, but, unlike most others, it has flat slide valves in place of piston valves, which frequently give trouble when made so small, or if they do not give actual trouble,

commonly cause serious loss of steam from leakage. The slide valve for each cylinder is an ordinary D valve, but it has an extra passage outside what would be the outside of a plain D valve ; this passage and the space commonly used for the exhaust, are alternately used for giving steam and for exhausting, according to the direction the engines are required to run. The extra passage in the slide communicates with an additional port in the valve face prompt and certain manner so puzzling to the uninitiated public.

Messrs. Roger & Co. also make a larger and more powerful type of gear, with horizontal cylinders and worm-wheel gear on the same principle. They have a very neat method of connecting them to work from the bridge, also for making them to steer by hand as well as steam ; the details being carefully and substantially arranged.



Pepper's Steam Steering Gear.

of the cylinder, the steam passes to and from the cylinder, also alternately, by means of this extra port, or by what would usually be the exhaust port. The direction in which the steam passes, and, in consequence, the movement of the rudder to starboard or port, is decided by means of a starting valve in the steam chest situated midway between the cylinders to which the main steam and exhaust valves are attached, and where a small plain D valve covers ports to the alternate steam and exhaust pipes to the cylinders, when the helm is in the desired position. The slightest motion, however, of the small steering wheel moves the starting valve so as to admit steam to the engines to drive them in the required direction ; the engines, by means of the usual hunting screw, bring the starting valve back to mid-position, and they follow the slightest movement of the hand wheel in the

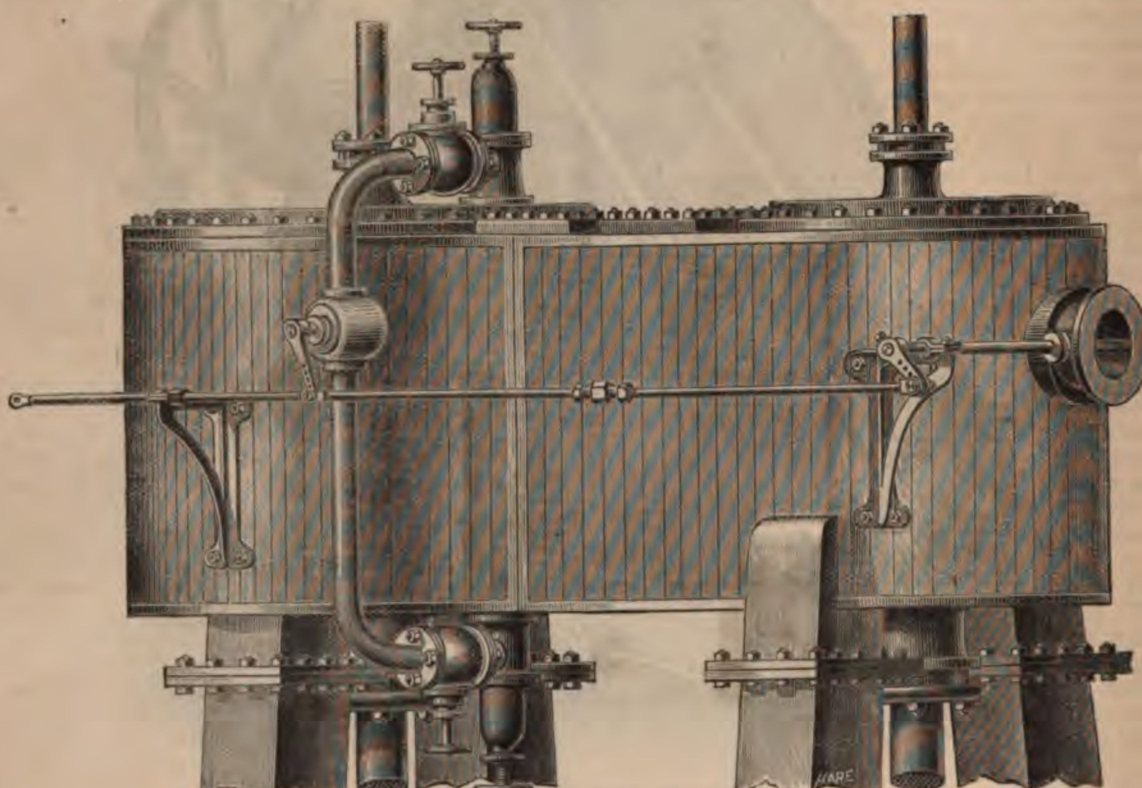
MESSRS. DURHAM, CHURCHILL & CO.

This firm exhibit their well known governors in various forms. It is not many years since marine engine governors were so uncertain and ineffective, that even when fitted they were seldom connected ; and there are probably few of our older sea-going readers who have not spent many a weary hour at the throttle-valve handle, unless they adopted the plan we once heard the chief engineer of one of the largest commercial steamers afloat unblushingly advocate, and "eased the engines down till there was no racing left in them." He had had what was then supposed to be the best type of governor fitted for his last round voyage ; it was put into action on several occasions at first, but found to be practically useless. To be effective, the first requisite in a marine engine governor is instantaneous action, which can be best attained by ample power ; in

these governors a slight increase in speed admits steam to a steam cylinder having its piston connected to the throttle-valve, which is completely closed ; it is re-opened wide as soon as the speed falls below the normal, the changes from full open to shut, and from shut to full open, being very rapidly made. Messrs. Durham, Churchill & Co. state that they have at present on order for the Admiralty twenty-seven of these governors, a large proportion of them being for the torpedo boats now being built.

A recent addition has been made to the governors for use with compound engines. Though no serious racing takes place with a governor that so promptly shuts off the steam entirely, the action is not so instantaneous with compound as with simple engines, owing to the continued expansion of the steam shut in the high pressure cylinder and the receiver between the high and low pressure cylinders, combined with the effect of the condenser vacuum on the large low pressure piston. This arrangement is illustrated. It will be seen that a pipe connects the upper and lower ends of the compound cylinder, screw down stop valves cut off communication with this pipe close to the cylinder, when the governor control is not required, but when its action is needed they are opened and a free communication established between the ends of the cylinder whenever the steam is cut off from the high pressure cylinder by the governor, thus establishing an equilibrium on both sides of the low pressure piston, allowing any steam to pass directly into the condenser, and effectually preventing any increased speed; when the governor again opens the throttle-valve, a connection with the governor rod, as shown, closes a valve on the connecting pipe, so that the communication is closed.

Messrs. Durham, Churchill & Co. also show a large pair of piston rings which are expanded by their patent spring arrangement. They have the springs formed in a very simple manner, which effectually expands the rings and gives the spreading action so necessary for keeping a piston tight ; the rings also are perfectly free, and would accommodate any distortion in the cylinder.



Governor for Compound Engines.

MESSRS. COCHRAN & CO.

Messrs. Cochran & Co., of Birkenhead, are exhibitors under Group 7, Classes 26 and 40. The exhibit under Class 26 is a modification of Messrs. Cochran and Co.'s now well-known vertical boiler. About 1,200 of these boilers are now at work for marine and other purposes, varying in size from 10 to 800 square feet of heating surface. The chief modification in this boiler—illustrated in longitudinal and transverse vertical sections and in sectional plan, in Figs. 1, 2, and 3 respectively—is the employment of a pair of tubular flues for the fire grates, and the hemispherical or egg-shape ends, employed to give the maximum strength of shell. The essential features of the old boiler, namely, the employment of horizontal tubes in the vertical boiler with an external smoke box, are still maintained. These modifications have been necessitated by the great increase in the size of the boilers now manufactured by Messrs. Cochran and Co., the boiler shown having 800 square feet heating

surface, which is capable of evaporating in ordinary work from 70 to 80 cubic feet of water per hour, indicating about 200 H.P. It is obvious that the cylindrical flues employed in this larger boiler are much stronger for large size boilers than the hemispherical furnaces usually adopted in these boilers of smaller sizes, which would be impracticable without elaborate staying. The upper part of the boiler is cylindrical with a spherical top and recessed tube plate. The lower part of the boiler is approximately semicylindrical with a flat end in front, and at the back the ends of the furnace and bottom of the combustion chamber are closed with fire bricks resting on an iron plate as shown.

This boiler, then, has all the advantages of the return tube horizontal marine boiler, whilst from its vertical form, it occupies the least possible amount of space, with

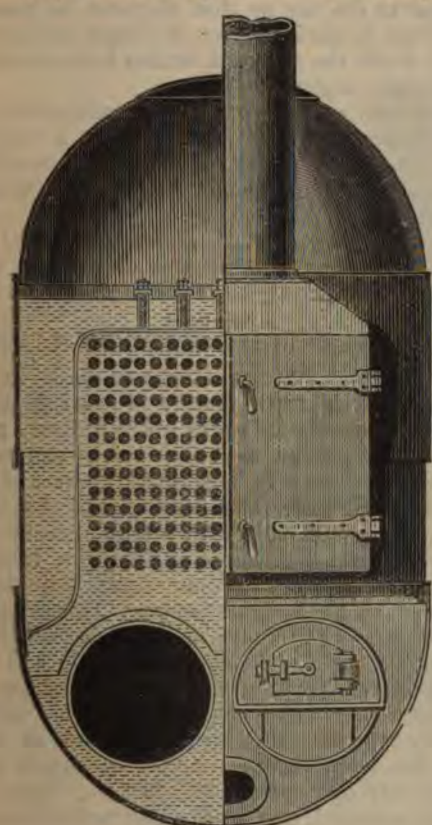


Fig. 1.

a large area for accumulation of steam, and great accessibility for cleaning, which cannot be obtained in the case of the ordinary horizontal boiler. For land purposes this boiler has the immense advantage of requiring no brick setting, thus a great saving in the installation is effected.

Under Class 40, Messrs. Cochran & Co. show a patent water-tight bunker door (Fig. 4, see p. 68). These doors are arranged to be worked from deck by the usual screw arrangement, from any suitable position, and can at any time be closed, so as to make a watertight partition. The main advantage and novelty in these doors is that the door is provided with a knife edge at the bottom, which enables it to cut through any coal or similar obstruction, and thus to close tightly as it descends, without any necessity for the coal or rubbish being cleared out at the slides. This, though simple, is a most important improvement as the slides of such doors are invariably more or less obstructed by coal or dirt, and the

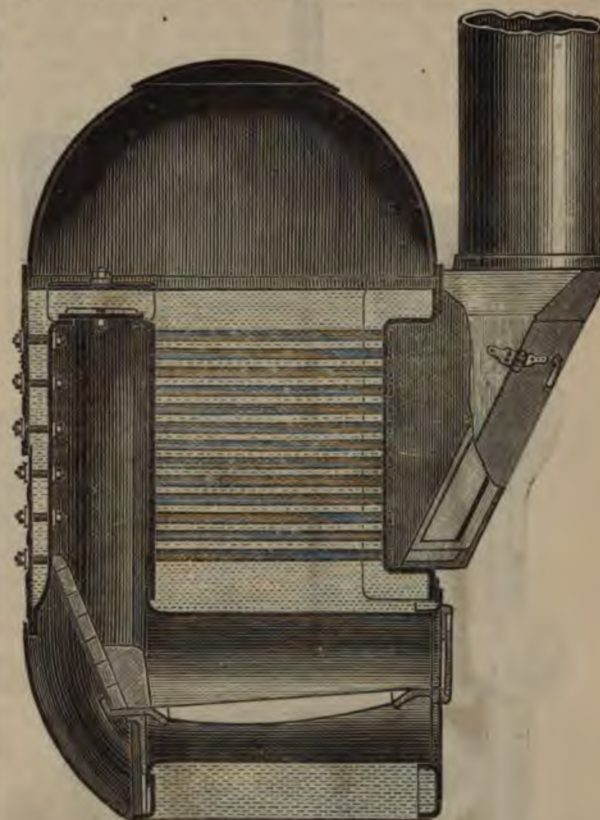


Fig. 2.

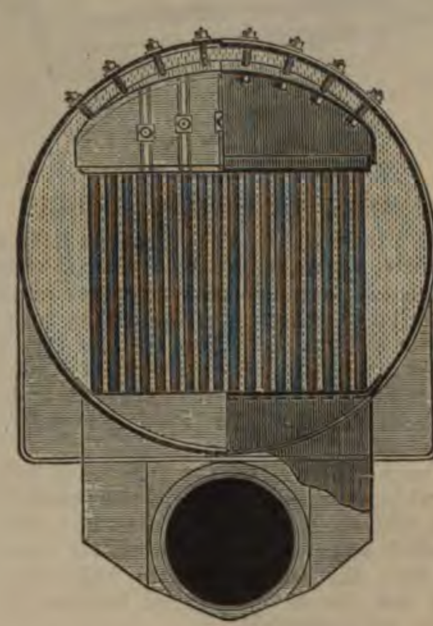


Fig. 3.

closing of such doors to be effective must be prompt and instantaneous when required.

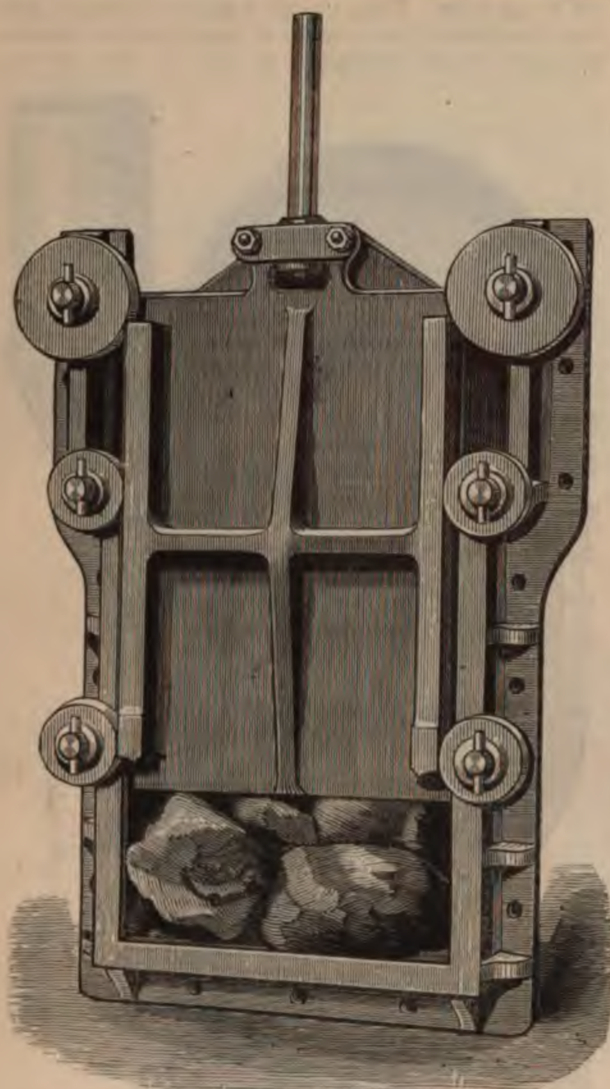


FIG. 4 (*see Page* 67.)

MESSRS. FIELDING & PLATT.

MESSRS. FIELDING & PLATT have a large and complete exhibit of Mr. Tweddell's hydraulic rivetters, &c., they have, as shown by numerous engravings, that have appeared in the pages of this Journal, such a varied number of designs that there are now very few rivets in a ship or a boiler they cannot get at, and effectually close. Some of these machines are made under patents in which Mr. Tweddell, Mr. Fielding and Mr. Platt are jointly associated.

The machines are all connected to one of their accumulators, which is supplied by one of their vertical pumping engines, with the usual automatic connection to starting valve which stops the engines when the accumulator is at the top; the pressure also to which the water is pumped can also be easily varied between 150 lbs. and 1,500 lbs. per square inch.

The water pressure is shown attached to various hydraulic cranes and also a travelling crane which are used to move or support the work in hand or the rivetters. A number of the machines are shown doing various work about a portion of a ship, and thus giving some idea of the ease with which rivets in what would be commonly supposed to be inaccessible to a machine rivetter are satisfactorily closed. A specially useful machine is the keel rivetter; this is fitted to a small travelling carriage, running on tram rails laid parallel to the keel, a heavy counterbalance weight supports the rivetter through a system of parallel bars, so that it always maintains a horizontal position, the whole machine is mounted on a pin, so that it is free to move in any desired direction, and it is easily adjusted to any rivet in the keel; there is a screw in the fixed head which by means of a hand wheel puts an initial pressure on the head of the rivet, and effectually keeps the machine in position whilst it is being closed; the dies are placed very close to the top so that they can be used on the upper rivets in the keel, even in vessels having very flat floors in which the garboard strakes leave the keel sometimes at right angles.

We specially noticed some of the machines were formed with cylinders and pistons worked to a curve whose centre coincides with the fulcrum of the machine, thus saving complicated joints and giving entire freedom from side strains.

Messrs. Fielding & Platt also show a novel form of rotary engine driving a dynamo direct at a very high speed; we hope shortly to illustrate this.

PHOSPHOR BRONZE COMPANY, LIMITED.

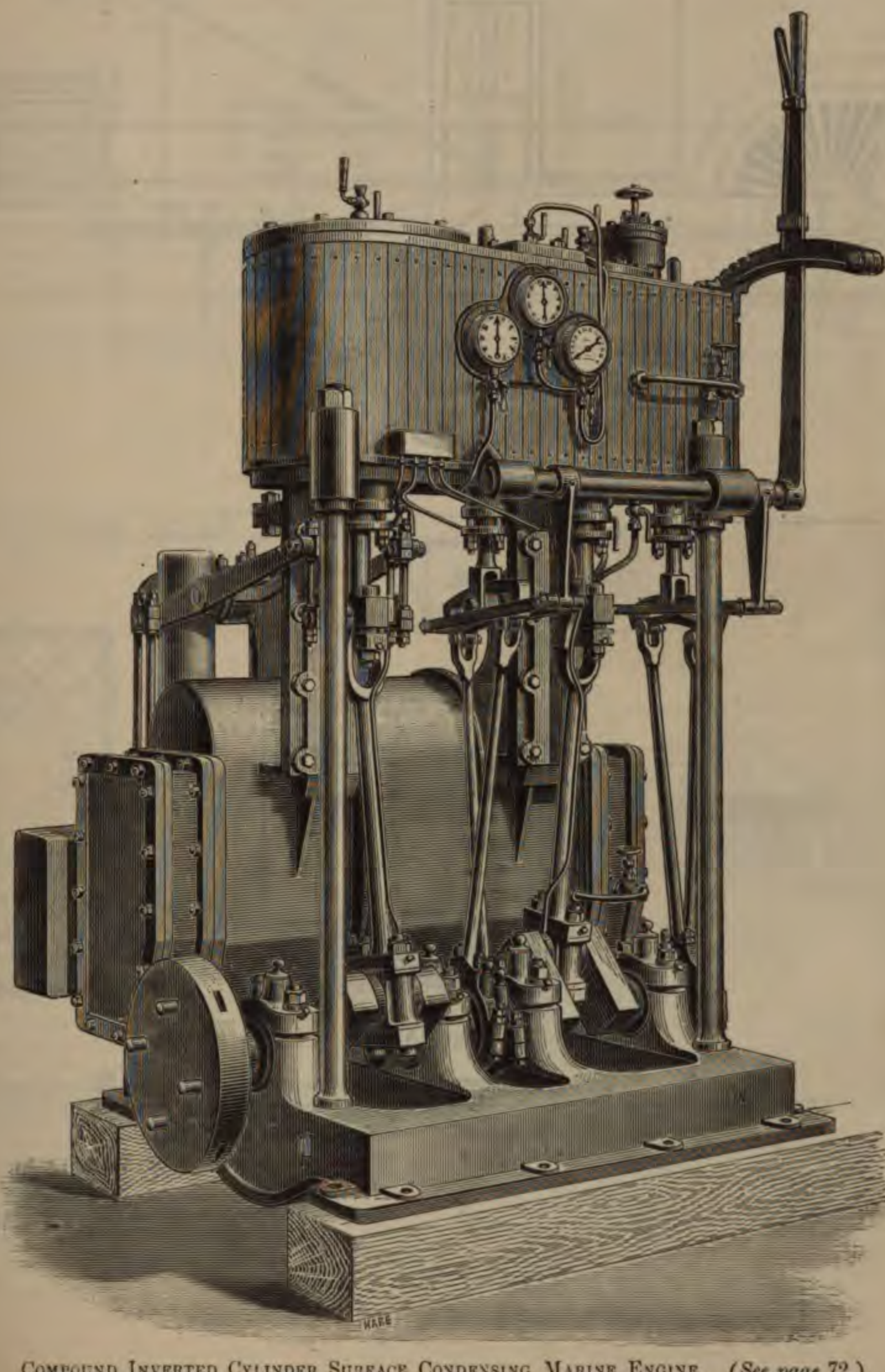
THE PHOSPHOR BRONZE COMPANY have on view at their stand their usual display of bearings that have worked satisfactorily for weeks where ordinary gun metal ones would only stand days, slide valves and valve faces that have stood three or four times the wear of ordinary slide valves and valve faces, bronze bolts that have been tested and broken only with a tensile strain equalling steel bolts, sheet for valves, solid-drawn tubes, spring wire, and the other numerous objects with which our readers are doubtlessly quite familiar. This company have now numerous competitors in the field, but they seem to be quite capable of holding their own; and certainly, in one respect, they have the great advantage of many years experience. Their customers are not called on to make any experiments or to run any risk of disastrous results, but know beforehand what to expect and what they can rely upon in actual practice. Their stand is tastefully arranged, and forms an attractive feature.

THE LEEDS FORGE COMPANY, LIMITED.

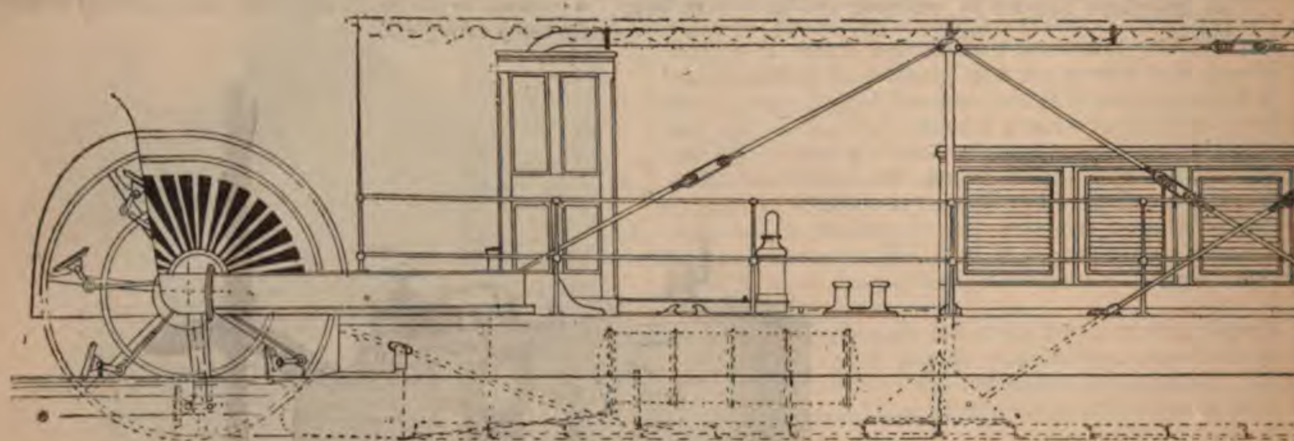
Fox's corrugated furnaces are an essential part of every exhibition of engineering articles, and they form a prominent feature in the machinery gallery of the Inventions Exhibition. Five large flues, which are perfect as regards workmanship, form a pyramid which catches the eye from all directions. They have been corrugated by the splendid special plant recently put down by the Leeds Forge Company making these furnaces, and their regularity and uniformity leave nothing to be desired. Fox's flues are now rapidly becoming a necessity in modern steamship boilers; steam pressures carried at sea are increasing by leaps and bounds, and as long as boilers are practically confined to the ordinary type, the furnaces cannot be constructed to pass the Board of Trade without being specially strengthened, and these flues are at present the

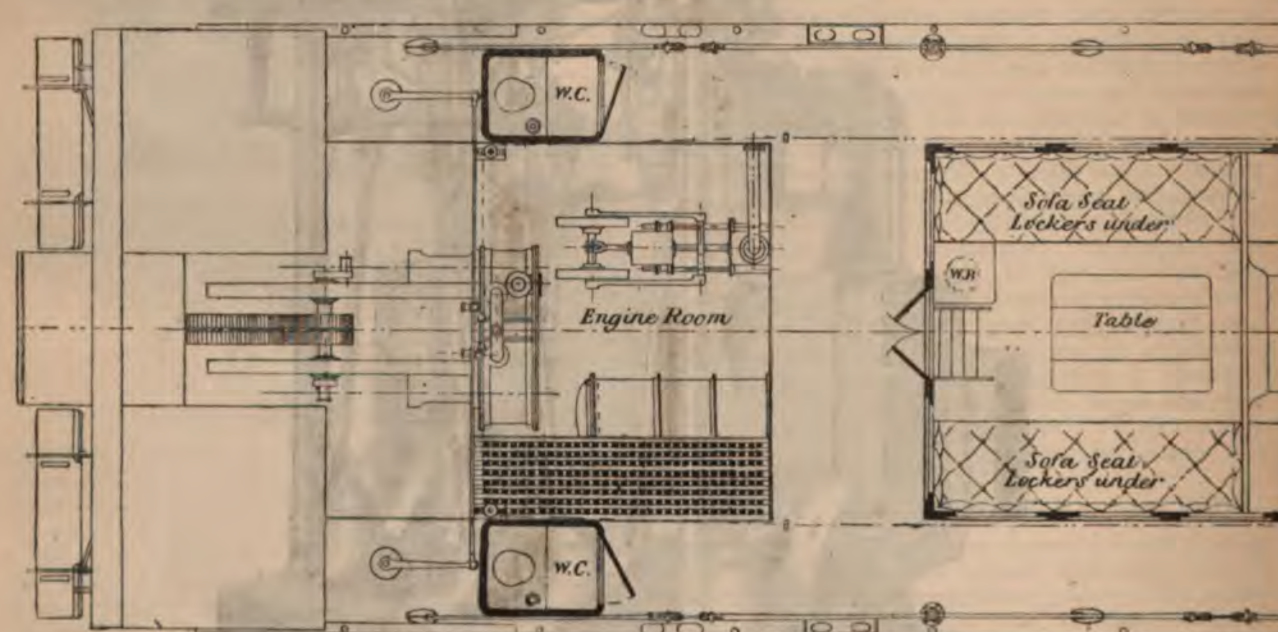
only way this can be satisfactorily done. Triple expansion is now the recognized practice, and we are continually hearing that quadruple expansion is only a question of a few years; the high pressures carried and purposed will undoubtedly cause a large demand for these flues, and we have no doubt that a rich return will be reaped from a speciality which was developed and put into practice with an enormous amount of patience and at a very large outlay.

They also exhibit a double-flanged manhole mouthpiece, pressed and flanged without weld out of a single plate. This is a splendid piece of workmanship, and we would advise any of our readers who visit the Exhibition not to leave without seeing it. The stand is, as usual, elaborately finished—marble floor, chaste brass hand rail, luxurious velvet couch, and mirror panels, form a contrast to the rough and ready finish deemed sufficient by many exhibitors.



COMPOUND INVERTED CYLINDER SURFACE CONDENSING MARINE ENGINE. (*See page* 72.)

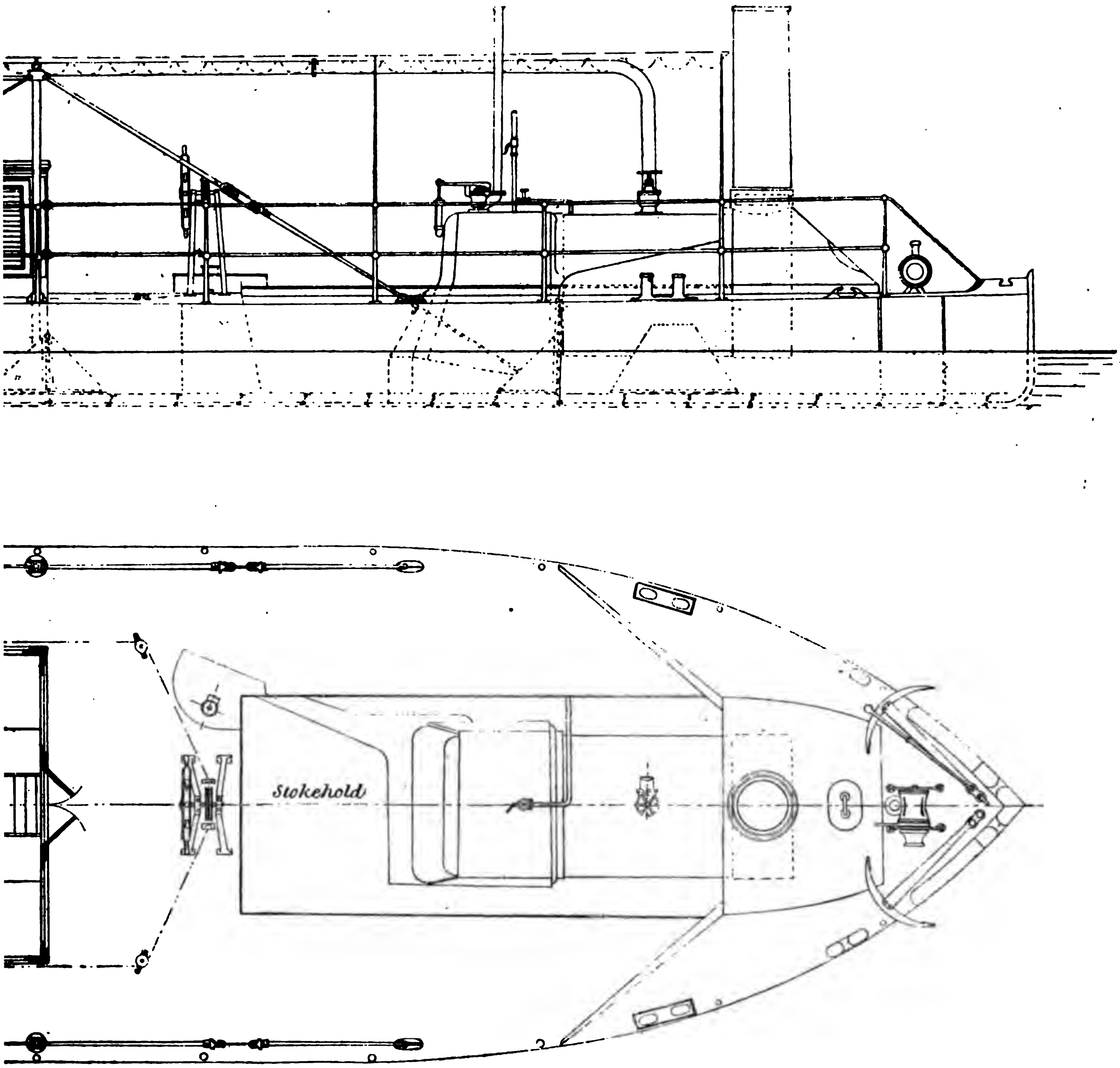




STERN WHEEL S

BUILT BY MESSRS

(For



BOAT FOR BRAZIL.

' & SON, MILLWALL.

age 72.)

COMPOUND INVERTED CYLINDER SURFACE CONDENSING MARINE ENGINE.

Alexander Shanks & Son, Arbroath, and 27, Leadenhall Street, London, exhibit a pair of engines of the above type. (See page 69.) The design is neat, and the details well worked out. The engines are open fronted, having two polished wrought-iron columns. The wearing surfaces are all large, the surface being obtained by increasing the length of the journals, instead of increasing the diameter of the shaft, which gives a more durable surface. The piston stroke is larger than is usually given with this class of engine, and the connecting rods and other parts are all of proportional length. These engines are complete with air, circulating, bilge, and feed pump, the two latter being of gun metal. A considerable number are at work and we understand very satisfactorily so. A complete set of lubricators is provided, to enable the engines to make long continuous runs. These engines are well designed and proportioned throughout.

STERN WHEEL STEAM BOAT.

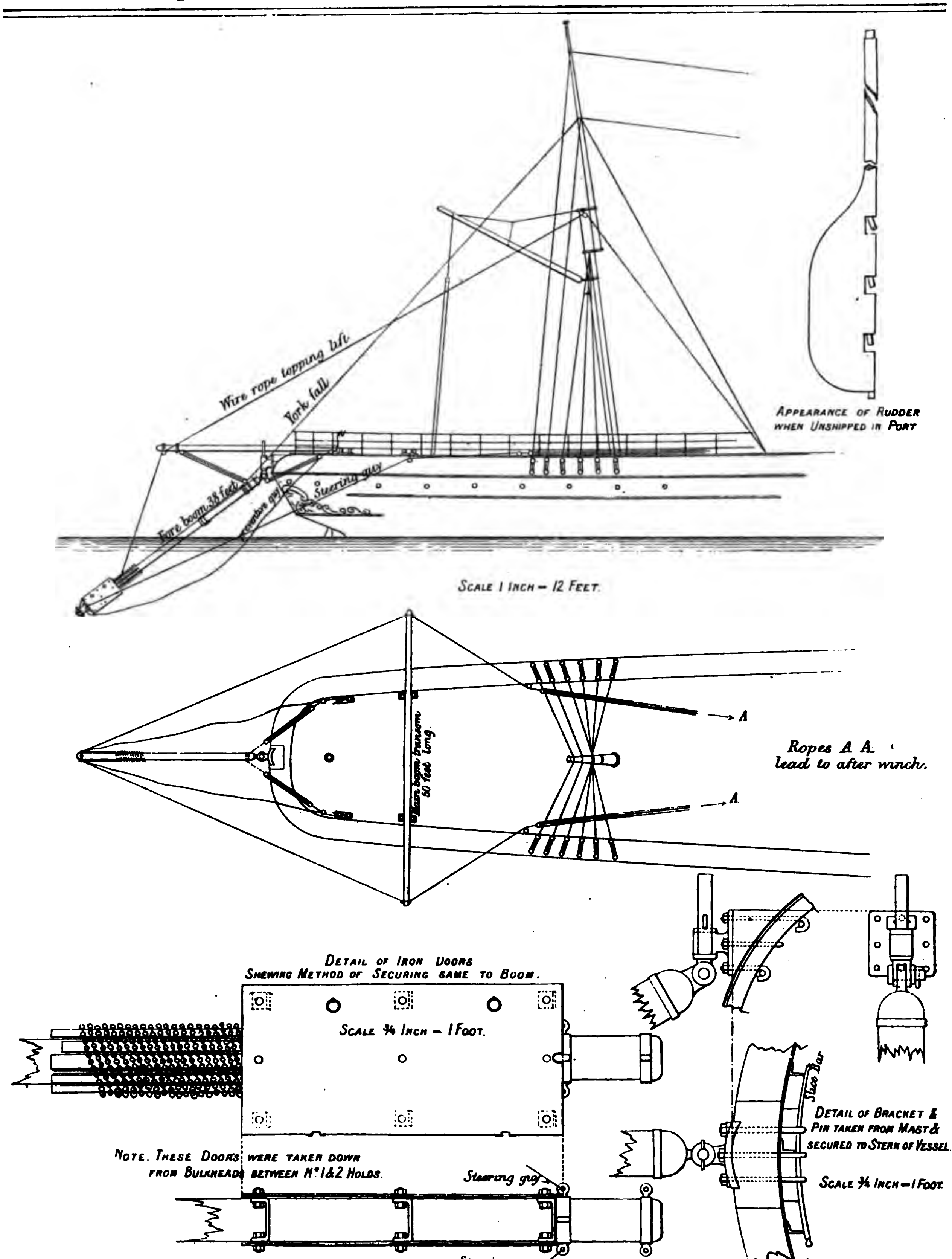
We give in this month's issue a double page illustration of a stern wheel boat lately launched by Messrs. Forrestt & Son, of Millwall and Limehouse, for the Brazilian Government. Her principal dimensions are :—Length on deck, 50 ft. ; breadth extreme, 13 ft. ; depth, 2 ft. 10 in. ; load draft 15½ in., with a displacement of 17 tons. The hull is of steel, built in four sections, shell plating ⅛ in. thick ; the deck is also of steel covered with linoleum. The engines, which indicate 150 H.P., are compound surface-condensing, high pressure cylinder 8 in. diameter, low pressure cylinder 14 in. diameter, the length of stroke being 10 in., and the number of revolutions per minute being 425. The crank-shaft, piston and connecting rods are all of steel. The two feathering paddle wheels are 6 ft. 4 in. diameter, worked by a spur wheel from the main engines. The surface-condenser is of copper. The boiler for supplying steam to the engines is placed forward, and is of the locomotive type, made entirely of steel, 7 ft. long and 3 ft. 6 in. diameter, and has a heating surface of 445 square feet, grate area 13 ft. 6 in., and the area of the fire box 75 square feet, giving a total heating surface of 520 square feet ; working pressure 120 lbs. per square inch. The accommodation for officers and crew is to be found in the mahogany deck-house amidships, having settees upholstered in blue rep, which can be used as berths when required, the furniture being of polished mahogany. The crew's quarters are very comfortably fitted up with lockers, table, &c. The boat steers very well, and is fitted with two rudders worked by a steering wheel forward of deck-house. Owing to the shallow depth, and the heaviest weights of machinery being at the extreme ends of the boat, trussing posts and rods are fitted to increase the longitudinal strength. The representatives of the Brazilian Government present at the official trial were Admiral Azavedo and Captain Carvalho. The speed obtained was 9·1 knots, which is highly satisfactory, considering the state of the weather, a high wind blowing at the time rendering the water very lumpy. The boat has now been taken to pieces and packed at the builders' yard for shipment abroad.

BREAKDOWNS AT SEA.

(*For illustration, see opposite page.*)

We are again favoured with particulars of a breakdown, and a rough-and-ready method of repair, which befell the s.s. *Gloucester* on her voyage from Bristol to New York. In the course of her voyage across the Atlantic she encountered a heavy gale from the W.N.W., commencing on the 4th April, and upon the 5th the rudder broke, the vessel falling off her course, and she consequently became unmanageable until sunset on the 6th. The weather then having moderated somewhat, a jury rudder was commenced by the deck hands, consisting of a mizen trysail boom, and an anchor at each end secured by chains, and it was of the shape of a fish tail at the after end. This device proved useless, there being so much wood about it as to make it float almost on the surface of the water. A second jury rudder was then commenced under the auspices of the engineer, and was constructed as follows :—To the after end of the mizen trysail boom were affixed two iron doors, taken from the 'tween deck bulkhead, between the fore and main holds. These were secured to the boom by bolts on each side, and by strong stays used therewith, which were made from the 'tween deck hatch bars. The other end of the boom was secured to the stern of the vessel by a swivel joint, as shown in detail in the sketches. This was made up as follows : The bracket at the mizenmast that usually carries one end of the boom was cut away, and was bolted to the stern as shown, the timber backing being made from one of the lower deck hatch beams, this being hard and dry. As it was not wide enough, it was cut into two pieces, which were secured together by ⅜ in. dowel iron pins. The whole was secured by six 1⅛ in. bolts, one end being made to hook over long slice bars passing over three angle iron frames, as shown in the sketch. These were backed up with hard wood. The goose-neck iron from the main trysail boom was then fitted to the bracket ; but this goose-neck soon broke, and was afterwards replaced by the one from the foremast, fitted to the bracket with as long a bolt as possible, screwed at the end for a nut, a good forelock being fitted in to keep the nut from slipping back. This apparatus proved very successful, until the boom broke short off, close to the iron doors ; but as these latter were secured by the guys, they were soon hauled on board, and were then fitted in a similar manner to the fore trysail boom, this latter boom being strengthened close to the doors by fishing it with chains, as shown in the sketch. This last jury rudder, when guyed as shown in the sketch, proved quite serviceable, and enabled the ship to steer very well, with moderate weather, at 7½ knots. When the weather became too bad, the vessel lay to, and the rudder was hoisted on board. Eventually the vessel reappeared at the Mumbles, thirteen days after the accident, seven of which had been lost while she was knocking about in an unmanageable condition, and whilst the three rudders were being made.

It is evident, we think, that the jury rudder was eventually constructed in a most substantial and workmanlike manner, and very great credit is due to the engineering staff for the aptitude with which they made use of such appliances as were to hand, and for the persistence with which they carried on the work until successful.



Breakdowns at Sea (*see Page* 72).

THE LONDON AND COLONIAL ENGINEERING COMPANY.

WE are pleased to draw the attention of our readers to a noteworthy effort that is being made under the above title, and practically under the auspices of the well-known firm of iron merchants and engineers, Messrs. D. & W. Robertson, of 31, Lombard-street, London, and of Sydney.

This company are laying themselves out especially to Colonial buyers. We are more particularly interested in the marine work produced by this company, of which we herewith illustrate the types of vertical and horizontal compound surface-condensing engines.

Figs. 1 and 2 show the front and back respectively of the horizontal compound surface-condensing engine, which is certainly quite novel in design, being extremely compact, and well balanced with the centre of gravity kept as low as possible.

The plain rectangular bed-plate carries the whole of the engine pumps and condensers, the passages connecting

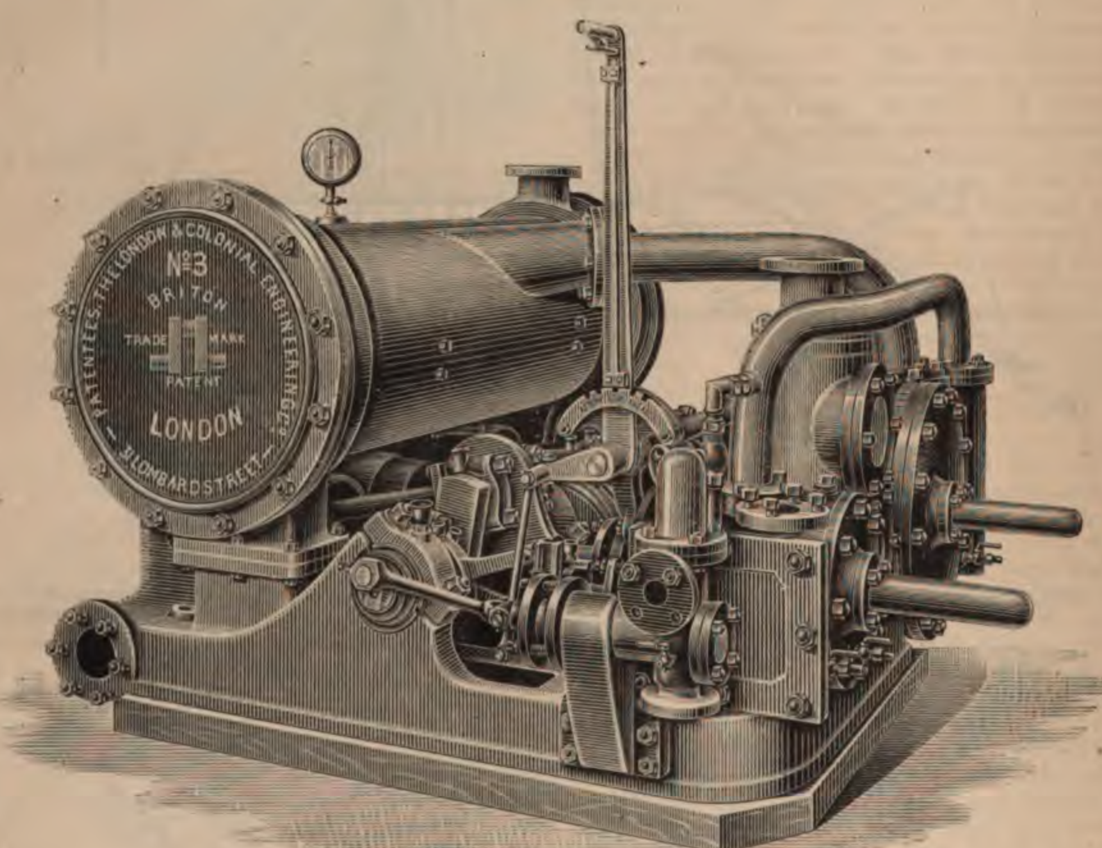


FIG. 1.

HORIZONTAL COMPOUND SURFACE-CONDENSING ENGINE (*front view*).

produce engines and boilers, steam cranes, winches, and other machinery for land and marine purposes of the very best material, design, and finish, at marvellously low prices for the work. The stand they take is that for Colonial export, the losses attending the slightest hitch or break-down of an engine, boiler, or machine is so enormously greater than the prime cost of the engine or goods, that an attention to simplicity, strength, and perfection of detail, and a thorough system of test and superintendence of all parts of the goods, before shipment, are of the first importance to give satisfaction to the circulating and air pumps, which lie between the cylinders and guides respectively, being cast in the bed-plate, and thus many external pipes are dispensed with. The high and low pressure cylinders are placed side by side at one end of the bed-plate, with the circulating pump between them, the guides being bored and placed upon the opposite end of the bed under the condenser, with the air pump between them.

The two-throw crank is placed in the middle of the bed, passing through, but without touching, two cast steel bridles, or slotted dog cranks, by which the pistons

and cross-heads are connected together. These allow long return cranks to be used from the cross-heads to the crank shaft, thus placed close to the front of the cylinders.

The circulating and air pumps are provided with open-mouthed plungers, and are worked from a single eccentric on the middle of the shaft. The feed-pump is seen at the end of the shaft in fig. 1, worked from an eccentrically-placed crank-pin. All the slippers and bearings are made with an exceptional amount of bearing surface, and made adjustable for wear with the least possible trouble.

The condensers are horizontal, and have a large condensing surface, formed by Muntz metal tubes secured to Muntz metal tube-plates by brass ferrules. The circulating water passes through the lower, and returns through the upper tubes, and is discharged at one end at the top. The condensed steam falls through one of the hollow feet on which the condensers stand, and flows into the air pump through one of the passages cast in the bed.

Steel is freely used in these engines for piston-rods and other parts, and the valve link gear allows the eccentric rods to be brought into a direct line with the valve spindles.

Figs. 3 and 4 show front and back elevations respectively of the inverted cylinder condensing marine engine, which is of a more usual type than the horizontal engine we have just described. As will be seen from the illustrations, taken from photographs, the engine and condensers are very well balanced, the air-circulating and feed-pumps being worked by rocking levers from the cross-heads of the engines.

The condenser surface comprised in such little space is very large, viz., three superficial feet per indicated horse-power, but for warm climates even 50 per cent. more than this is provided.

The proportions of these engines are very liberal throughout in pursuance of the general system of the London and Colonial Engineering Company, considerably exceeding Lloyd's requirements.

The company also make a point of every engine, boiler, or machine being tested under certificate by an independent inspector accustomed to Government work during process of construction, and also a certificate is furnished that every part, portion, and detail of the engine has been duly placed in the packing-cases. This last point may, to some, seem trivial; but those Colonial purchasers who have smarted under the annoyance and serious loss of finding only when the engine or machine is being erected hundreds of miles inland that the whole work is at a standstill for want of some trivial detail omitted through carelessness, will thoroughly appreciate this precaution.

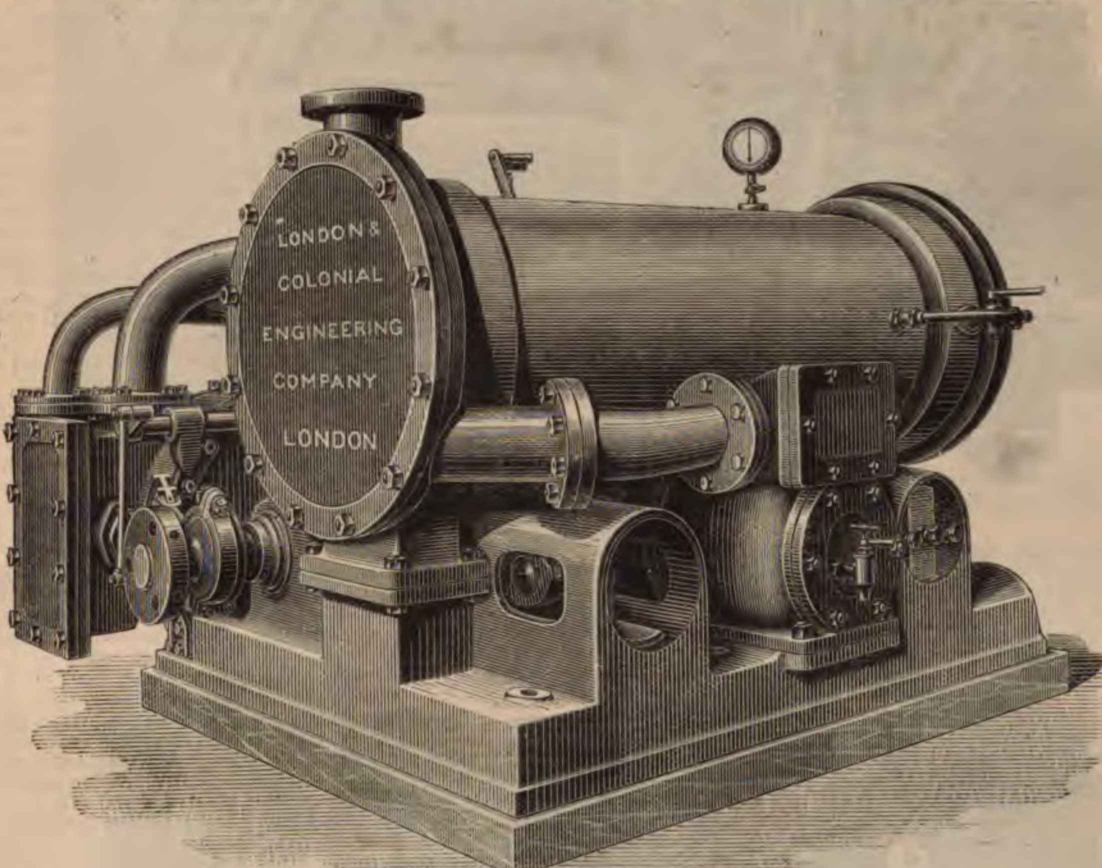


Fig. 2.

Horizontal Compound Surface-Condensing Engine (*back view*).

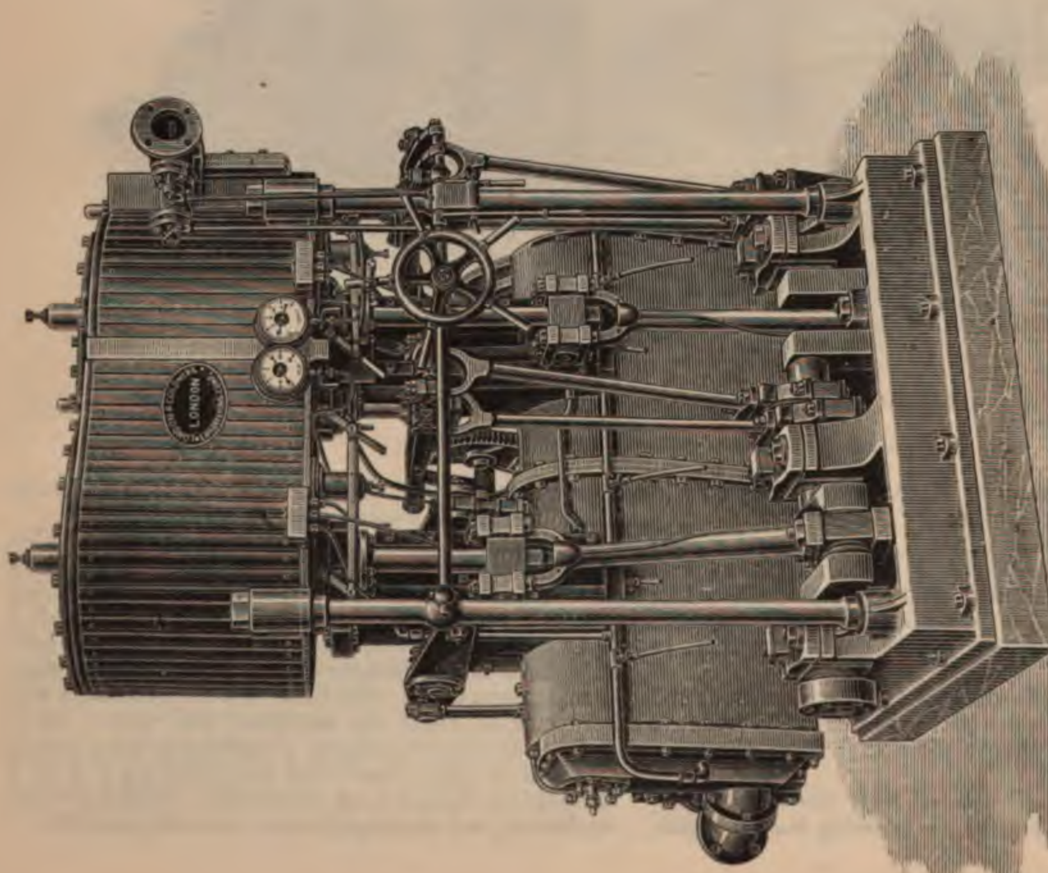


Fig. 3.

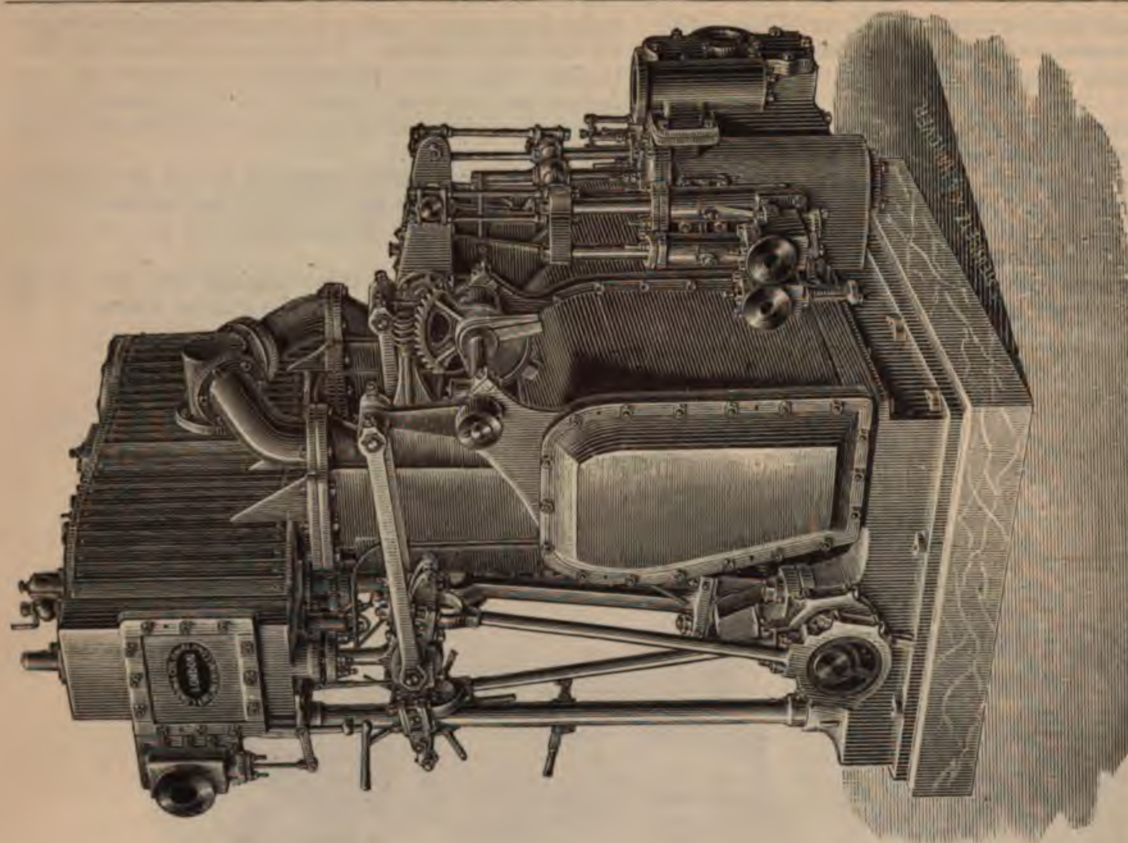


Fig. 4.

Inverted Cylinder Condensing Marine Engine (*see Pages 74 and 75*).

LAUNCHES AND TRIAL TRIPS.

[*We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of* The Marine Engineer *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—Ed. M. E.]

LAUNCHES—English.

Howe.—On April 28th this vessel was launched at Pembroke Dock, and another barbette ironclad is thus added to the navy. The *Howe* was commenced on June 7th, 1882, and is built of steel. Her dimensions are as follows:—Length, 325 ft.; breadth, 68 ft.; launching weight, 4,850 tons; total weight when equipped, 9,700 tons; mean draught, 26 ft. 9 in. Her armament will be four 63-ton guns in barbette turrets, six 6-inch broadside Vavasseur guns, twelve 6-pounders, ten Nordenfelt guns, and five Whitehead torpedoes. The engines, constructed by Messrs. Humphrey and Tennant, are of 7,500 H.P., and she will carry a crew of 430 officers and men.

Langdale.—On April 29th Messrs. W. H. Potter & Sons launched from their shipbuilding and engineering works, Queen's Dock, Liverpool, an iron sailing ship of the following dimensions:—Length, 280 ft.; breadth, 40 ft.; depth of hold, 24·0 ft.; tonnage, b.m., 2,180; nett register, 2,000 tons, with deadweight capacity of 3,200 tons. As the vessel left the ways she was named the *Langdale* by Miss Newton, daughter of the owner. The *Langdale* has been built to the order of Messrs. J. D. Newton & Co., of Liverpool, and is the sixth vessel built for that firm by Messrs. Potter. She has been built under special survey, and takes the highest class in Lloyd's, her scantlings being in excess of their requirements. She has iron deck fore and aft, steel masts and yards, quarter stanchions, and all the most recent improvements. She is to be commanded by Captain Kelly, and will be at once placed on the loading berth.

Ireland.—On April 29th a new paddle steamer for the Holyhead and Kingstown mail service of the City of Dublin Company was launched from the shipbuilding yard of Messrs. Laird at Birkenhead. The ceremony of naming the ship the *Ireland* was performed by Lady Claud Hamilton. Her length over all is 380 ft., 38 ft. beam, depth 19 ft. 3 in., with a tonnage of 2,590 tons O.M. She is built entirely of Siemens' steel, and is subdivided by eight steel watertight bulkheads carried to the upper deck, one of these bulkheads being between the engine-room and each boiler room, insuring, in the event of damage to any two compartments, sufficient buoyancy to keep the vessel afloat. The machinery, which has been made by Messrs. Laird, consists of a pair of oscillating engines, having cylinders of 102 in. diameter, with 8 ft. 6 in. stroke, which will be supplied with steam at 30 lbs. pressure by eight steel boilers. An arrangement of fans and engines is provided for putting the stokeholes under air pressure, and it is expected that the machinery will develop at full power 6,000 I.H.P., and that the vessel will attain a speed of at least 20 knots. The passenger accommodation will be replete with every comfort and luxury. In all there will be accommodation for about 200 first class passengers. The vessel throughout will be illuminated with the electric light, with the exception of the post-office, which will be lighted with Messrs. Pintsch's patent oil gas. The steering gear and anchor gear will be worked by steam, and all the arrangements conducing to the safety and comfort of passengers will be of the most modern and improved type.

Greystoke.—On April 30th Messrs. Edward Withy & Co., West Hartlepool, launched from their yard a fine iron-screw steamer, built to the order of Messrs. Ropner & Co., West Hartlepool. Her principal dimensions are, 286 ft. by 37 ft. 2 in. by 19 ft. 11 in. This large steamer was commenced and launched in the short time of 86 days. The vessel has a long raised quarter-deck, with short break poop, long bridge-house enclosing main hatch, and top-gallant forecastle. The main, bridge and quarter-decks, bulwarks, rails, skylights, charthouse, &c., are of iron. The vessel is fitted with double bottom for water ballast, all fore and aft, on the cellular principle, two donkey-boilers by Riley Bros., Stockton-on-Tees, four horizontal steam winches, by Clarke, Chapman & Co., Gateshead, Napier's patent windlass on forecastle-deck, and three of Wasteney's Smith's patent stockless anchors, hauling up into hause-pipes, and is rigged as a schooner, with iron lower masts. The vessel has been built under Lloyd's special survey, for the 100 A 1 Class, and under the supervision of Captain Rooke, West Hartlepool. She will be fitted with triple expansion engines of 170 N.H P., and two single-ended boilers by Messrs. T. Richardson & Sons, Hartlepool. On leaving the ways the vessel was christened *Greystoke*, by Master Leonard Ropner.

Thomsonian.—On May 1st there was launched from the works of Messrs. Joseph L. Thompson & Sons, North Sands shipbuilding yard, Sunderland, a screw steamer of the following dimensions:—260 ft. by 36 ft. by 18 ft. 6 in., having a deadweight carrying capacity of 2,350 tons. The engines are by Mr. John Dickinson, of Sunderland, of the compound surface-condensing type, 150 N.H.P.

Donegal.—On May 2nd there was launched the s.s. *Donegal*, built by Messrs. Craig, Taylor & Co., of Stockton-on-Tees, to the order of Liverpool owners. Her engines are of 50 N.H.P., the cylinders being 18 in. and 36 in. in diameter by a stroke of 24 in., and the working pressure 85 lb. They were built by Messrs. Westgarth, English & Co., of Middlesbrough, and gave an I.H.P. of 281, and a speed of 9½ knots.

Woolton.—On May 2nd there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt and Co., at Southampton, an iron sailing ship of 2,100 tons nett register, and of the following dimensions:—Length, 274 ft. 7 in.; breadth, 40 ft. 3 in.; depth of hold, 24 ft. 2 in. The vessel has been built to the order of Messrs. R. W. Leyland & Co., of Liverpool, and exceeds the highest requirements of both Lloyd's and Liverpool Underwriters' Registry. She is full rigged and fitted with a trysail on mainmast. Ample accommodation is provided for captain and officers in a full poop. A large iron deckhouse is fitted amidships for petty officers and crews. She is fitted with Emerson & Walker's patent combined capstan windlass for working anchors and chains. During construction the vessel has been under the supervision of Captain Semple. As the vessel left the ways she was christened the *Woolton* by Mrs. George Leyland.

Flamingo.—On May 6th Messrs. Earle's Shipbuilding and Engineering Company, Limited, Hull, launched from their yard an iron steam fishing cutter, which they have built for the Great Grimsby Ice Company, Limited. The vessel, which is classed 100 A1 at Lloyd's, is for carrying fish from the Grimsby Fishing Fleet. Her dimensions are as follows:—Length, p.p. 137 ft.; breadth 21 ft. 6 in.; depth of hold 11 ft. She has a raised quarter deck aft, extending from the engine and boiler space, and forecastle forward, and is designed with good shear so as to make her a fast and at the same time seaworthy ship. She is ketch rigged with a large spread of canvas, and is fitted with a powerful steam winch and trawling gear arrangements. This boat will not only carry fish but will also be employed for trawling. She will be fitted by the builders with their triple compound engines of 80 N.H.P. The ship was named the *Flamingo* as she left the ways. This makes the tenth steam vessel built by Earle's Company for Grimsby Fishing Companies.

Britannia.—On May 11th there was floated out from one of the building docks at Messrs. Laird Brothers' Works, Birkenhead, a twin-screw steamship, built to the order of the Telegraph Construction and Maintenance Company, for their cable laying and repairing service. The vessel was named the *Britannia*, the ceremony of christening being performed by Mrs. Halpin, wife of Captain R. C. Halpin, the marine superintendent of the company. The *Britannia* is of special design, and is fitted complete with water-ballast tanks, cable tanks, paying-out and picking-up engines and gear, and all such appliances of the most approved kind for the service for which she is intended. She has been built of very exceptional strength, for, though constructed wholly of steel, the scantlings are the same as required for iron to meet the requirements of Lloyd's 100 A spar-deck class and the Liverpool Underwriters' highest class. Her dimensions are:—Length, 240 ft.; beam, 34 ft., depth of hold to spar deck, 25 ft.; with a gross tonnage of about 1,500 tons; fitted with two sets of vertical compound engines, capable of developing a combined power by indicator of 1,000 H.P.; shafts and principal parts of machinery and the boilers of steel. This vessel has been entirely completed in the building dock both as regards hull and machinery, excepting only the masting, and was floated with steam up, and immediately proceeded on a preliminary trial trip.

Heathpool.—On May 13th there was launched from the yard of the Sunderland Shipbuilding Company, Limited, a finely modelled screw steamer, built to the order of H. T. Morton, Esq. The vessel is 210 ft. B.P. by 32 ft. beam by 16 ft. 6 in. depth of hold, and is specially adapted for the coal trade, having water-ballast all fore and aft, large hatchways, three powerful steam winches and donkey boiler by Messrs. Welford Bros., steam steering gear by Messrs. R. Roger & Co. of Stockton, and patent windlass by Messrs. Clarke, Chapman & Co. All details are arranged with a view to the rapid loading, discharging and efficient carrying of coal and ore cargoes. The main engines are by the North Eastern Marine Engineering Company, Limited, Sunderland, having cylinders 28 in. and 54 in. by 33 in. stroke. The vessel was named *Heathpool*, by Miss Wilson, of Sunderland.

Chazalie.—On May 13th there was launched from the building yard of Messrs. Upham & Sons, at Brigham, a fishing smack intended for the North Sea fishing trade, the property of Mr. Hellier, of Hull.

Richard Greaves.—On May 14th Mr. David Jones launched from his yard at Portmadoc a new schooner. Length, 87 ft.; breadth, 22 ft. 6 in.; depth, 11 ft.; 118 tons register. This vessel was built to the order of Captain John Davies, of Borth, Portmadoc.

Fairholme.—On May 14th Messrs. Richardson, Duck & Co., of Stockton-on-Tees, launched from their yard an iron sailing ship, named the *Fairholme*, built to the order of Messrs. Carr & Ashcroft, of Liverpool. This vessel has been built on the same lines as the *Manx King*. The *Fairholme's* dimensions are:—264 ft. extreme length, 39 ft. extreme breadth, 24 ft. depth of hold, and about 1,700 tons nett register. She has been built under special survey to the highest class at Lloyd's, and in many respects the *Fairholme* is in excess of Lloyd's requirements. The christening ceremony was performed by Miss Walmsley, daughter of Alderman Thomas Walmsley, J.P., of Bolton. The *Fairholme* is ship-rigged, and has full poop, with state rooms for a number of cabin passengers, and accommodation for captain, officers, and six apprentices, an iron house for the petty officers and crew, and all the most recent improvements for the efficient and economical working of the vessel. The *Fairholme* is intended for the Australian, Californian, and Indian trades.

Offerton.—On May 16th there was launched from the shipbuilding yard of Messrs. S. P. Austin & Son, a screw steam vessel, built to the order of H. T. Morton, Esq., Biddick Hall, of the following dimensions and description:—Length overall, 198 ft.; breadth extreme, 30 ft.; depth of hold, 13 ft.; gross tonnage about 750 tons, with full forecastle for crew; bridge house; long raised quarter-deck; cellular bottom for water ballast, fore and aft. Rigged as a three masted schooner, and fitted with bilge keels, built under special survey of Lloyd's Classification Committee for the highest class, plated with Siemens-Martin steel, and fitted with all the modern appliances for the London coal trade of the Lambton Company, including steam winches and donkey boiler; patent windlass and steam steering gear. She will be fitted with compound surface condensing engines of 90 N.H.P., by the North Eastern Marine Engineering Company, Limited. As the vessel left the ways she was named the *Offerton*, by Miss Badcock.

Algonia.—On May 16th there was launched from Messrs. Joseph L. Thompson & Son's North Sands Shipbuilding Yard, Sunderland, the *Algonia*, a handsomely modelled screw steamer, to the order of Messrs. W. Tapscott & Co., of Liverpool, of the following dimensions: Length, 330 ft.; breadth, 42 ft.; depth, 28 ft. 3 in.; and a cargo capacity of about 5,000 tons. The vessel is made entirely of steel and is steel riveted, the plates being from the well-known works at Consett. She will be fitted with Messrs. Thomas Richardson & Sons' engines on the triple-expansion principle, of 1,600 H.P., working at a pressure of 150 lb. She has been constructed under the supervision of Mr. F. J. Pilcher, of Liverpool.

Salamander.—On May 16th there was launched from the shipbuilding yard of Messrs. Schlesenger, Davis & Co., Wallsend, an iron screw yacht of the following dimensions:—Length over all, 130 ft. 6 in.; breadth, moulded, 20 ft.; depth of hold, 10 ft. 6 in., yacht measurement; tonnage, 211 tons. She is built with a clipper stem and figure head, and a square stern with long overhang. She is constructed on very fine lines, and is expected to travel at a good rate either under steam or sail. The vessel has been constructed under special survey, and will be classed in Lloyd's Yacht Register, her scantlings being in most cases considerably in excess of Lloyd's requirements. She is built for Mr. Frederick Power, of London. The ceremony of christening was performed by Mrs. Davis, who named her the *Salamander*. The yacht will carry four boats, one of these being a steam launch. She will be fitted with a direct-acting steam windlass, supplied by Messrs. Harfield & Co., whilst Messrs. Davis & Co.'s patent steam steering gear will be placed on the deck house. She will be rigged as a topsail schooner, and will carry a large spread of canvas. The engines are on the Perkins' system, with triple expansion and a working pressure of steam of 500 lbs. to the square inch, and it is expected they will develop great power on a very small consumption of fuel. The sizes of the cylinders of the *Salamander* are 7¾ in., 15 13-16 in., and 22¼ in. diameter, with a stroke of 15 in.

Richard Hayward.—On May 16th there was launched from the shipbuilding yard of Messrs. W. Doxford & Sons, Pallion, Sunderland, a four-masted sailing ship, built to the order of Mr. W. E. Jones, of Caernarvon, and of the following dimensions:—Length, 258 ft.; breadth, 38 ft.; depth, 23 ft. The vessel was named the *Richard Hayward*, by Mrs. Williams, of Trebarth, Bangor.

Takachiho Kan.—On May 16th the *Takachiho Kan*, a powerfully-protected cruiser, built by Sir William G. Armstrong, Mitchell, and Co., for the Japanese Government, was launched from the shipbuilding yard of the firm at Low Walker. This vessel is in every respect similar to the *Naniwa Kan*, built by the same company to the order of the Japanese Government, and launched on March 17th, and fully described in the May number of this Journal. Both vessels were designed by Mr. W. H. White, and are the swiftest and most heavily-armed cruisers at present in existence. They are also the largest war vessels that have been hitherto built by the firm. They may be briefly described as enlarged *Esmeraldas*, with substantial improvements. In dimensions the new cruisers are almost identical with the *Iris* and *Mercury* despatch vessels of the Royal Navy, and the *Leander* class of partially-protected cruisers. They are 300 ft. in length, 46 ft. in breadth, and draw 18½ ft. of water, and are of about 3,600 tons displacement. They have twin-screw engines, which are to develop 7,500 horse-power at least, and their estimated speed is from 18 to 18½ knots. The armament includes two 28-ton 26 centimetre guns, mounted on centre pivot automatic carriages as bow and stern chasers. On each broadside there are three 15 centimetre guns of 5 tons each, also on centre pivot automatic carriages of Elswick design, and along the broadsides there are also placed no less than 10 1-in. machine guns, and two rapid-firing guns. There are two military masts, in the tops of which four of the improved Gatling guns made at Elswick will be mounted. All the guns, except those in the tops, are carried on the upper deck, and all of them have strong steel shields protecting the gun and crews from rifle and machine gunfire. Besides the gun armament, each vessel will have a complete armament of locomotive torpedoes ejected from four stations, two on each broadside, situated at a small height above water. There are two separate engine-rooms and two separate stoke-holes. Immediately after the launch, the *Takachiho Kan* went to the establishment of Messrs. R. & W. Hawthorn to receive her engines. The sister vessel, which has just returned from the same establishment after receiving her engines, will very shortly be ready for sea. Amongst the numerous company present at the launch were Mr. Kawasi (Japanese Ambassador), Madame Kawasi, Mr. Yasuda, Mr. Soma, Mr. Nakuda, Mr. Ijuin, Mr. Miyakawa, Mr. S. Hazi and Mr. Z. Miyabara (under whose supervision the hull and engines respectively have been constructed), Mr. Seki, Mr. Moritomo, Mr. Asaska, Mr. Murano, Mr. Katoume, Mr. Fukushema, Captain Hatchida (Japanese Naval Attaché), Lieutenant G. Hayasaki, Mr. Yobhiward, Mr. Kawishema, Mr. and Mrs. C. Mitchell, Captain Noble, Lord Sudeley, H.R.H. the Duke of Genoa, Lieutenant Acton, Lieutenant Pignone, Colonel Collingwood, Major Bridgford, Mr. H. F. Swan, Mr. Westmacott, Mr. H. O. Rendell, Mr. Macdonnel, Mr. W. H. White, Mr. D. Black, Mr. and Mrs. D. C. Browne, Hon. Mr. Cairns, Mr. Swinton, Captain Soliani and Captain Mayana (Italian Navy). A temporary stage had been erected at the bows of the ship, upon which the principal ladies and gentlemen assembled. After a photograph had been taken the chocks were knocked out, and as the vessel slowly began to glide towards the water, Madame Kawasi broke a bottle of champagne against its side and named it *Takachiho Kan*. The ship passed with increasing speed steadily down the ways into the river amidst the cheers of thousands. Light refreshment provided in the model room concluded the very successful proceedings. The arrangements were carried out under the supervision of Mr. R. S. White, manager of the Low Walker yard.

LAUNCHES.—Scotch.

General Gordon.—On April 20th there was launched from the shipbuilding yard of Messrs. A. & J. Inglis, Glasgow, an important addition to the Dublin and Glasgow Steampacket Company's fine fleet of vessels in the form of an exquisitely modelled steel screw steamer. The steamer as she moved from the ways received the memorable name of *General Gordon*, the ceremony of naming being gracefully performed by Mrs. Collins, of Highfield, Keloniside, Glasgow. After the launch, the company present adjourned to the model-room, where the customary toasts were duly pledged. The dimensions of the *General Gordon* are as follows:—Length of keel, 230 ft.; breadth of beam, 31 ft.; depth, 15 ft. 3 in.

Moravia.—On April 28th Messrs. Aitken & Mansell launched from their yard at Whiteinch a screw steamer of about 1,400 tons register, and 750 I.H.P., which has been built to the order of Mr. James Cormack, Leith. The vessel received the name *Moravia* from Miss M'Kenzie, of Edinbarnet, Dumbartonshire. The hull of the *Moravia* is built of steel, specially designed for the requirements of the Russian trade, and combines all the most recent improvements in construction. The machinery is on the newest compound principle, and will be fitted by Messrs. Hutson & Corbett, Glasgow.

Sunbeam.—On April 29th there was launched from the shipbuilding yard of Messrs. T. B. Seath & Co., Rutherglen, an iron twin-screw steamer intended for passenger service in and around Morecambe Bay. Her dimensions are:—105 ft. by 16 ft. by 7 ft. 6 in. She will be fitted with two pair surface-condensing engines, capable of working at 100 lb. pressure, N.H.P. 36. Messrs. Hutson & Corbett, Glasgow, are the engineers. Her probable speed is estimated at 12 miles an hour.

Galatea.—On April 30th this yacht was launched at Port Glasgow by her builders, Messrs. John Reid & Sons. Her principal dimensions are:—Length in water line 86·80 ft.; breadth, 15 ft.; depth, 13 ft.; 90-ton yacht Racing Association measurement, and 92 Royal Thames measurement. She is built of steel and is cutter-rigged. Her keel, which is inside, weighs about 80 tons, this weight being to counterbalance the proportions of her masts, spars, and sails. The *Galatea* has been built for Lieutenant Heron, R.N.

Willem Eggerts.—On April 30th Messrs. H. M'Intyre and Co. launched from their yard on the Cart, at Paisley, an iron sailing barque, named the *Willem Eggerts*, of the following dimensions:—Length, 250 ft.; beam, 36 ft.; depth of hold, 22 ft. She registers 1,270 tons, and has a carrying capacity of 2,075 tons. The vessel was christened by Mrs. Jaarsma, wife of Captain Jaarsma. The *Willem Eggerts*, when contracted for, was to the order of Messrs. P. H. Dixon & Co., Glasgow, but while in the course of construction was sold by that firm to Mr. N. Brantjes, of Purmerende, Holland, who intends her for the East India trade. She was built under the special survey of Mr. A. M. Taylor, constructing engineer and marine surveyor, Glasgow.

Her Majesty.—On May 1st Messrs. Barclay, Curle, & Co., Limited, launched, at Whiteinch, an iron paddle steamer for the Southampton and Isle of Wight Royal Mail Steam Packet Company, named *Her Majesty*. She is 185 ft. long, 20 ft. broad, and about 8½ ft. deep, and will be fitted by the builders with compound engines of about 700 I.H.P. She will be fitted out for the comfort and convenience of passengers similar to the other vessels of the company's fleet, all trading to the fashionable resorts of the Isle of Wight and neighbourhood. The vessel was named by Miss Short, daughter of the marine superintendent of the company.

Margaret Murray.—On May 2nd there was launched from the yard of the Grangemouth Dockyard Company a steel three-masted schooner, to the order of Mr. Murray, Annan, and Captain Waters, London, &c. She is of the following dimensions:—104 ft. by 23 ft. by 6 ft. She is intended for the Rio Grande and Newfoundland fish trades.

John o'Gaunt.—On May 2nd there was launched from the shipbuilding yard of Messrs. John Reid & Co., Port Glasgow, a steel barque of the following dimensions:—Length over all 234 ft.; beam extreme, 36 ft.; depth of hold, 21 ft.; nett register, 1,200 tons. The new vessel, which is classed 100 A1 at Lloyd's, has been built to the order of Thomas Bell, Esq., Liverpool, for whom Messrs. Reid built the *John Chisholm* and *Thomas Bell* more than 25 years ago. She was named the *John o'Gaunt* by Mrs. Gruzilier, wife of the captain, and will proceed to Liverpool, where she will load for Calcutta.

Charles Connell.—On May 4th Messrs. Charles Connell & Co. launched from their building yard, at Scotstoun, an iron sailing ship of 1,725 tons register, for Messrs. John Black & Co., Glasgow and London. This vessel has been built to class 100 A1 in Lloyd's Registry, and is fitted with every requisite for the rapid loading and discharging of cargo. As she left the ways she was named *Charles Connell* by Miss Augusta Arroll, and was immediately towed to her berth, where she loads a cargo for Rio Janeiro.

Moy.—On May 5th Messrs. Russell & Co. launched from their Greenock yard an iron sailing ship of the following dimensions:—Length, 260 ft.; breadth, 40 ft.; depth, 24 ft.; and of 1,600 tons. The vessel, which was named the *Moy*, has been built for Mr. James Nourse, of Liverpool. She is to be fitted with all the best appliances for navigation and for facilitating the loading and discharging of cargo. After the launch the *Moy* was towed to Port Glasgow, where she will be fitted out for sea.

Polar Light.—On May 7th the *Polar Light*, a strongly-built iron screw steamer of 100 tons burthen, built to the order of Messrs. Ross & Marshall, Greenock, was launched at Bowling, on the Clyde, by Messrs. Scott & Co. She is being fitted with powerful machinery by Messrs. Kincaid & Co., Clyde Foundry, Greenock.

Earl of Dunraven.—On May 13th there was launched from the shipbuilding yard of Messrs. Russell & Co., at Kingston, Port Glasgow, a barque-rigged sailing ship of the following dimensions:—Length, 230 ft.; breadth, 36 ft.; depth of hold, 21·75 ft.; and 1,300 tons nett register. She has been built to the order of Messrs. M'Allister & Co., London, and is intended for a general trader. As she left the ways she was named the *Earl of Dunraven*, and during the day she was towed to the harbour, where she will fit out. The *Earl of Dunraven* will be under the command of Captain Kerr.

Girvan.—On May 13th the London and Glasgow Engineering and Iron Shipbuilding Co., Limited, launched from their yard at Govan, a steel sailing barque, classed 100 A at Lloyd's under special survey. This vessel was built to the order of David Hunter, Esq., Ayr, and is to be commanded by Captain Nisbet, whose lady performed the ceremony of naming the vessel *Girvan*. The *Girvan's* principal dimensions are:—Length, 235 ft.; breadth, moulded, 36 ft. 3½ in.; depth to ceiling, 21 ft. 6 in.; gross tonnage about 1,335 tons. The accommodation in poop is arranged for captain, officers, and a few passengers, deckhouse amidships for petty officers, galley, &c., and topgallant forecastle for crew. The *Girvan* is the fifth vessel built by this firm for David Hunter, Esq.

Ailsa.—On May 14th the new club yacht of the Royal Northern Yacht Club was launched from the building yard at Fairlie. The vessel is a 66-ton cutter. Her length on the lead line is 70 ft., her extreme breadth 14 ft. 9 in., draught 11 ft. 9 in., and the hoist of her mainsail is 44 ft. Her bowsprit is rigged in the old style through the portholes, instead of over the stem. As the vessel left the ways she was named the *Ailsa*.

Kyle (dredger).—On May 14th Messrs. M'Knight, M'Creadie, and Co. launched from their yard at Ayr, a twin screw hopper dredger for the Ayr Harbour Trustees. When the vessel took the water she was named *Kyle* by Miss Paton, Oakbank, Ayr. Her dimensions are:—Length, 176 ft.; breadth, 30 ft.; depth moulded, 13 ft. 6 in.; gross measurement, 620 tons. The *Kyle* is designed for dredging in from 6 ft. to 30 ft. depth of water, and for lifting sand or free soil at the rate of 250 tons per hour. She is also to steam nine knots when loaded with 500 tons of dredgings. She has been extra strongly built, and, in order to obviate ordinary damages caused by grounding, the frames and bottom plating have been made of mild steel. Comfortable accommodation for the captain and crew is provided in the 'tween decks. Her machinery will be fitted by Messrs. Fleming & Fergusson, Paisley, and will consist of two pairs of compound surface-condensing direct-acting engines, having cylinders 18 in. by 33 in. by 24 in. stroke, and which have been constructed so as to work the dredging gear as well as propel the vessel. Steam of 80 lbs. per square inch will be supplied from two cylindrical tubular boilers, each 10 ft. diameter. The bucket ladder is 72 ft. long, fitted with 34 buckets, each having a holding capacity of 12 cubic ft. The buckets have been specially designed to dredge the hardest soil, the backs and bottoms being in one piece of cast steel; the links also being of cast steel. The hopper doors of this vessel are worked by steam power, having separate engines and shafting for raising and lowering the doors. She has been fitted with all the ordinary appliances of a stationary dredger, having side shoots for loading barges alongside. Provision has also been made for utilising the vessel for towing

purposes. The *Kyle* will be one of the most powerful dredgers in the country, being capable each day of 10 hours to carry and deposit 2,000 tons of soil. The hull and machinery have been constructed in accordance with specifications and drawings prepared by Mr. James Donaldson, consulting engineer, Glasgow, and the work carried out under his supervision.

Minnyhive.—On May 16th there was launched from the shipbuilding yard of Messrs. Robert Duncan & Co., Port Glasgow, an iron sailing barque of 1,300 tons net register. Her dimensions are as follows:—Length, 230 ft.; breadth, 36 ft.; depth of hold, 21 ft. 6 in. She is built to the order of Mr. T. C. Guthrie, and will be an addition to the Village Line of sailing ships, and is for a general trade. On leaving the ways she was named the *Minnyhive*, and was immediately afterwards towed to the harbour to be fitted out.

Torridon.—On May 16th Messrs. Alexander Hall & Co., Aberdeen, launched the *Torridon*, an iron sailing vessel of 1,500 tons register, measuring 245 ft. by 38 ft. by 22 ft. She has been built to the order of Messrs. Alexander Nicol & Co., Aberdeen, and is intended for the London and Australian trade. She is being fitted with steel masts, wire rigging, and all the most recent improvements.

Pleasure Yacht.—On May 17th Messrs. Hanna, Donald and Wilson, Paisley, launched a steel-built pleasure yacht of somewhat novel construction. She has four steel bulkheads, and measures 56 ft. over all by 7 ft. 8 in. by 5 ft. Steam of 100 lb. pressure is to be used, and the boiler is to be driven under forced draught. Electric lighting arrangements are fitted into the cabins, and she is also provided with a submarine and fishing lamp of 500 candle-power. A speed of 12 miles per hour is expected.

Glenlora.—On May 18th Messrs. Wm. Hamilton & Co. launched from their shipbuilding yard at Port Glasgow a steel sailing barque of the following dimensions, viz.:—Length between perpendiculars, 230 ft.; breadth, 36 ft.; depth, 20 ft. 9 in.; net register tonnage, 1,220. This vessel will carry 2,100 tons deadweight, and is fitted with all the latest improvements for facility and despatch in loading and discharging, including steam winches and boiler, steam windlass, steam pump-gear, &c. She has been built to the order of the Dundee Shipowners' Company, Limited, Messrs. W. O. Taylor & Co., Managers, and is similar to the *Glenafton*, recently built by the same firm for the same owners. She is built to the highest class at Lloyd's under special survey, and is considerably in excess of their requirements. This vessel has been constructed under the superintendence of Captain Smith, of Arbroath, the Company's overlooker, and will form an addition to their Glen Line of sailing vessels. On leaving the ways she was named *Glenlora* by Miss Henderson, daughter of Mr. Henderson, M.P.

Davaar.—On May 18th a new steel saloon passenger steamer, which has been built to the order of the Campbeltown and Glasgow Steampacket Company by the London and Glasgow Engineering and Shipbuilding Company, Govan, was launched. As the vessel left the ways she was named the *Davaar* by Miss Greenlees, Campbeltown, a daughter of one of the Directors of the Company. The *Davaar* is larger than either of the vessels at present belonging to the Campbeltown and Glasgow Company, being 213 ft. long, 27 ft. broad, and 13 ft. deep, with a gross tonnage of 520 tons. Every provision has been made in the new vessel for the accommodation of passengers. She is to be propelled by direct-acting compound engines, which will indicate about 1,400-horse power, and she is to attain a speed of 14 knots an hour. Captain Thomas Kerr, the Commodore of the Company's fleet, is to command the *Davaar*.

Albuera.—On May 19th there was launched from the yard of Messrs. James & George Thomson, Clydebank, a steel sailing ship, 235 ft. long, by 30 ft. beam, by 24 ft. 4 in. depth, moulded, and 1,600 tons register. This vessel has been built to the order and under the special superintendence of Captain Hardie, and is fitted with all the latest improvements both for working the vessel and for the comfort and accommodation of officers and crew. The name *Albuera* was conferred by Mrs. Archibald Russell, jun.

Waverley.—On May 19th Messrs. Hugh M'Intyre & Co., Paisley, launched from their yard on the river Cart a saloon steamer, which will act as consort to the *Meg Merriles* in augmenting the service between the Bromielaw and Kilmun route, now being carried on by Captain Robert Campbell and his two sons. As the vessel left the ways she was named the *Waverley* by Mrs. Hutson. The new steamer is 205 ft. long, 21 ft. broad, and 7 ft. 6 in. deep, moulded, or 2¼ ft. broader in the beam and 6 ft. longer than the *Benmore*. The *Waverley* left the Cart in charge of a tug on her way to Glasgow, where she is to receive her engines from Messrs. Hutson & Corbett, Kelvinhaugh. These are to be of the usual diagonal type, with cylinders of 52 in., and a 5 ft. stroke of piston. The *Waverley* will carry about 1,600 passengers.

Soudan.—On May 19th there was launched from the yard of Messrs. Russell & Co., Kingston, Port Glasgow, an iron sailing ship of 1,510 tons nett register. The following are her dimensions: Length, 250 ft.; breadth, 38 ft. 2½ in.; depth of hold, 23 ft. She has been built to the order of Mr. Gilbert M. Steeves, Liverpool, and under the superintendence of Captain J. M'Gill, of that city. The vessel is supplied with Emerson's windlass, is built to the highest class at Lloyd's, is fitted up with large poop, with all the latest improvements, and is suited for carrying a large cargo. She is to be engaged as a general trader, and will be commanded by Captain Richers, late of the ship *Anglesey*. On leaving the ways she was named *Soudan* by Miss Burton, Liverpool, and was afterwards towed to the harbour to be fitted out.

Richmond.—On May 20th a steamer built by Messrs. Gourlay Brothers & Co., per Mr. Charles Barrie, for a colonial firm, was launched from Camperdown Shipyard, Dundee. The vessel, which was christened the *Richmond* by Miss Barrie, is about 600 tons gross register, built of steel, and classed A 1 at Lloyd's. The following are her dimensions: Length, 178 ft.; breadth 27½ ft.; and depth of hold, 10½ ft. The *Richmond* is intended to trade between Sydney and the Richmond River, and has been specially constructed to carry a large cargo with a light draught of water. She has accommodation for 54 first-class passengers in the poop and 40 second-class passengers in the forecastle. Engines of 107 N.H.P. are to be fitted on board the steamer. Captain Mowat is to take the vessel out to Australia.

LAUNCH—Irish.

Elmina.—Not the least pleasing incident witnessed by their Royal Highnesses the Prince and Princess of Wales in Ireland, was the launch, on 23rd April, of a new steamer from the shipbuilding yard of Messrs. Harland & Wolff, Queen's Island, Belfast. The steamer was the *Elmina*, built for the African Steamship Company of Liverpool. So soon as the Royal party had embarked on board their yacht, *Osborne*, and she was loosed from her moorings, the signal for the launch to take place was made, and the *Elmina*, receiving her name from Mrs. Alexander Sinclair, wife of the manager of the company, glided immediately down the ways amid the cheers of the numerous spectators. When she got opposite the royal yacht, she fired a salute of 21 guns, which was answered by the *Osborne* as she steamed down the river. After the ceremony, the *Elmina* was towed to the crane-berth, opposite Messrs. Harland & Wolff's engine-works, where she will receive her machinery and outfit. She is the eighth ship which they have built to the order of the African Steamship Company, and is intended for the trade between Hamburg and the West Coast of Africa.

LAUNCH—French.

Bombe.—On April 16th the little Torpedo-cruiser, *Bombe*, was launched from the yard of Forges et Chantiers de la Méditerranée, at Graville, near Havre. The *Bombe* is the first of a new type of vessel specially designed for the French Government. She measures 196 ft. by 21 ft. 6 in. by 13 ft. 6 in. It is expected that the two engines of 1,800 I.H.P., driving two independent screws, will give a speed of 18 knots. Her armament will consist of two steel breech-loading guns of 4 inches, mounted on Vavasseur's carriages, three Hotchkiss's guns, and two guns for discharging Whitehead torpedoes. She has three pole-masts, steam steering gear, and the officers and crews cabins are very comfortable. Five other ships of this type are on stocks at Havre. The *Bombe* will be soon completed for the engine's trials.

TRIAL TRIPS.

Hercules.—On April 24th the new twin-screw tug *Hercules*—the latest addition to the extensive and well-equipped fleet of steamers owned by the Clyde Shipping Company—had her official trial trip on the Clyde. A duplicate of the *Gulliver*, and measuring 125 ft. by 21 ft. 6 in. by 12 ft. 3 in., she was built by

Messrs. Napier, Shanks & Bell, of Yoker, near Glasgow, and her engines, which indicate 560 H.P., were constructed by Messrs. Rankin & Blackmore, Greenock, and are known as Rankin's patent twin-screw engines. They have cylinders 23 in. and 42 in. in diameter, respectively, with piston stoke of 30 in., steam of 80 lb. working pressure being provided by a large single-ended steel boiler. Messrs. Rankin & Blackmore, have now made nineteen sets of engines of this type, five of them being for steamers of the Clyde Shipping Company. On the measured mile the *Hercules* steamed at the rate of 11·58 knots per hour, which was considered highly satisfactory. She is one of the most powerful tugs afloat.

Britannia.—On April 24th the screw steamer *Britannia*, lately built and engined by Messrs. S. and H. Morton & Co. Leith, for Messrs. James Currie & Co., of the same port, ran her official speed trials on the measured mile at Gullane Ness, on the Firth of Forth. The trials were very exhaustive and proved to be highly satisfactory. They extended over several hours, and were superintended by Mr. James Currie and Messrs. Davidson and Caldwell, consulting engineers. The average speed attained was 12 knots per hour. The *Britannia* is to be engaged on the Leith and Newcastle trade.

El Callao.—On April 25th the new screw steamer *El Callao* went on her trial trip on the Firth of Forth with satisfactory results. This vessel has been specially designed for the New York and Orinoco River trade, and has been built by Messrs. Ramage & Ferguson, Leith, to the order of Messrs. Walker, Donald & Co., Glasgow. Her tonnage is over 1,000 tons gross register, and she has exceptionally large stowage capacity for light cargo; also accommodation on the upper deck for 25 first-class passengers. All the requirements necessary to enable her to fulfil the American Board of Trade requirements have been carefully carried out, which includes fire extinguishing apparatus to every compartment in the ship. The speed trials were carried out on the measured mile in Gullane Bay, Firth of Forth, and a mean of the several trials gave a speed of 11½ knots per hour, which was considered highly satisfactory. This steamer is the fifth built for Messrs. Walker, Donald & Co. by Messrs. Ramage and Ferguson, and is the latest addition to their fleet trading in American waters, and will shortly proceed direct to America. From the date of signing the contract for this steamer until her delivery, only five months have elapsed.

Tartar.—On April 27th the steamer *Tartar*, specially built for Messrs. R. Walker & Co., Glasgow, to be engaged in the fish trade between the coast and Glasgow, went down the Firth on her trial trip. After tackling the measured mile at Skelmerlie—which she did at the rate of 13 knots per hour—the *Tartar* proceeded round the Kyles of Bute. She is 120 ft. long by 18½ ft. broad, and was built by Messrs. Scott & Son, Bowling, and engined by Messrs. Muir & Houston, Kinning Park.

Courage.—On April 29th the steamship *Courage*, built by Messrs. Raylton Dixon & Co., to the order of the Great Yarmouth Steam Carrying Company, proceeded to sea, making a most successful trial trip. This is the fifth steamer of the kind built by Messrs. Raylton Dixon & Co. for this Company (besides a fleet of 10 sailing vessels), and is to be employed as carrier between the trawling fleet in the North Sea and the London Billingsgate Fish Market. Her principal dimensions are 128 ft. over all; 21 ft. beam; 11 ft. 7 in. depth of hold. She is fitted with engines of 50 H.P., by Messrs. Blair & Co., Stockton, and will drive the vessel at sea an average speed of 11 knots. The engines are placed in the after part of the vessel, and the forehold is divided into two compartments, the smaller being for the stowage of broken ice, which she will carry out to the fishing fleet, where this is delivered to the trawlers, and in return she will receive from them the packed boxes, which are stowed in the main hold of steamer. The main hold is protected from the effects of external heat by being lined throughout with timber and caulked, the space between the lining of shell packed with non-conducting material, the same being the case under the deck. She is also fitted with steam capstan and every convenience for trawling when not employed in fish carrying.

Messrs. Dixon & Co. have also at present in hand a fleet of similar small vessels for the Baroness Burdett Coutts.

Dolphin.—On May 2nd the new paddle tug steamer *Dolphin*, built and engined by Messrs. Blackwood & Gordon, Port Glasgow, went down the Firth of Clyde on her trial run, when she attained a speed of fully nine knots per hour. She measures 90 ft. by 17 ft. by 8 ft., is fitted with engines of 40 H.P., and is to be employed by her owners, Messrs. Tancred, Arrol & Co., at their extensive works at the Forth Bridge.

Sitonia.—On May 2nd the screw steamer *Sitonia*, which has been built and engined by Messrs. Wigham Richardson & Co., Neptune Works, near Newcastle-on-Tyne, proceeded to sea for her trial trip. She is a vessel of 950 tons deadweight carrying capacity, built to the order of Messrs. De la Condamine & Johnston, of London, for Messrs. William Thorburn & Sons, of Uddewalla, Sweden, and is intended principally to trade between Uddewalla and London with general cargoes and passengers, accommodation for a limited number of the latter being provided amidships. The engines are on the compound surface-condensing principle, of 750 I.H.P. The boilers are of steel, and work at 80 lb. pressure. All the latest improvements both in machinery and fittings are provided, and on the trial trip were found to work to the very great satisfaction of everyone interested. The vessel was taken for a series of runs over the measured mile off Whitly, and a mean speed of 11 knots was obtained. The vessel and engines have been built under the superintendence of Mr. Thomas Todd, of 20, Billiter-street, London.

Tay.—On May 6th the screw steamer *Tay*, recently built by Messrs. Pearce Brothers, Dundee, to the order of the Dundee and Newcastle Steam Shipping Company (Limited), ran her official trial trip on the Tay. On the measured mile she attained a speed equal to 10 knots per hour. The engines, which are of 35 H.P.N., and are supplied with steam of 100 lb. pressure, worked very smoothly. The vessel measures 106 ft. by 19 ft. by 8½ ft., and is a very handy boat for the coasting trade, in which she is to be employed.

Bempton.—On May 6th the steamer *Bempton*, of London, built by Messrs. Edward Withy & Co., Hartlepool, and owned by Williamson Lamplough, Esq., left Hartlepool on her trial trip under the command of Captain Turner. During the trip the vessel behaved remarkably well in a heavy seaway, and proceeded to Cardiff to load for India.

Giovanni Bausan.—On May 9th the Italian protected cruiser *Giovanni Bausan*, which has been built by Sir W. G. Armstrong, Mitchell & Co., for the Italian Government, made her official trial off the mouth of the Tyne, and was in all respects successful. The vessel, which is under the command of H.R.H. the Duke of Genoa, proceeded to sea, having on board her own officers and crew, including Commander Count Candiani; Lieutenants Actou, Pignone, Manfredi, and Viale; Captain Soliani, naval architect; Chief Engineer Yanaboni (under whose supervision the hull and engines respectively have been constructed); and Captain Lobrano, naval attaché of the Italian Government in London. There were also present representatives of the builders and engine makers, including Mr. H. H. Swan, Mr. W. H. White, Commander Grenfell, R.N., Mr. Cross, Mr. Mavor, Mr. Gulston; also Mr. G. Miyabara, of the Japanese Navy, Mr. Ulm, of the Austrian Navy, Captain Mayana, Chevalier de Martius, and others. The machinery was under the charge of Mr. Foley, manager of Messrs. R. & W. Hawthorn; and immediately the visitors arrived on board the engines were put out at full speed, the boilers working under forced draught, and the vessel then proceeded to make a series of runs, lasting continuously, without easing, for six hours, some of the runs showing a speed of over 18 knots, and the average for the entire six hours was over 17½ knots. The engines worked during the whole time with the most perfect smoothness and regularity, and the boilers supplied abundance of steam without the least indication of priming or anything to mar the entire success of the trial, which was of the most exhaustive character. The forced draught was obtained from four powerful fans, and an incidental effect of their operation was to keep both the stokeholds and engine room extremely cool. It is to be observed that the duration of the trial under forced draught was over six hours, which is probably about double the time that any vessel has previously been run under similar conditions, the time now stipulated for ships building for the British Admiralty being four hours. On the completion of the trial the vessel returned to the Tyne, and as she already had her gun and torpedo armament fitted, it only remained for her to take on board her final stores, and fill up with coal, and last week she proceeded to her destination.

Ulunda.—On May 12th the new steamer *Ulunda*, built by Messrs. Alex. Stephen & Sons, Linthouse, for the Halifax Steam Navigation Company's Canadian and French lines, was tried over the measured mile, with a full cargo on board. The speed obtained was over 10½ knots, and the vessel proved herself in every respect satisfactory. The engines are of the most modern type, the consumption of coal being only 17 tons for 24 hours. The vessel is fitted with turtle backs fore and aft, water ballast arrangements, steam winches, steam steering gear, and the most

recent and approved appliances. Every possible improvement has been introduced in the equipment to make the vessel adapted for the Atlantic carrying trade, all being carried out under the care of Capt. Taylor, Aberdeen, superintendent to the company. Saloon accommodation amidships has been provided for 30 passengers, and the 'tween decks are fitted for 30 second class and 100 third class. After embarking her passengers the vessel started for Quebec and Montreal under command of Captain S. R. Hill.

Grenadier.—On May 14th the new paddle steamer of Mr. David MacBrayne, the *Grenadier*, went on her trial trip on the Clyde. She ran down the Frith at easy speed, and made the measured mile at the rate of 16 knots an hour, which she maintained during the whole day. The *Grenadier* turned into Rothsay Bay, without, however, touching at the pier, and then steamed through the Kyles. The *Grenadier* was built by Messrs. J. & G. Thomson, Clydebank, and her lines, though on a smaller scale, are similar to those of the *America*. The *Grenadier* is 220 ft. long, 23 ft. broad, and 9½ ft. deep. Her engines are compound surface-condensing, working at a pressure of 95 lbs. Steam is supplied by two boilers of the navy type, the total H.P. being 1,200. Besides the natural draught, there are fans for producing a forced draught, fitted upon Howden's system. The vessel has a saloon fore and aft, the two combined occupying two-thirds of the length of the steamer. She has a dining saloon forward and aft for both classes of passengers, and a promenade deck extends over both saloons. She is designed for the trade of Oban, Skye, and the North. She is fitted with Muir and Caldwell's steam steering gear and steam windlass.

Ching Wo.—On May the 15th this handsome steamer left Middlesbro dock on her trial trip. She has been built by Messrs. Raylton Dixon & Company, of the Cleveland Dockyard, to the order of the China Shippers Mutual Steam Navigation Company, and especially adapted for the China tea trade. Her leading dimensions are 332 ft. over all by 38 ft. by 27 ft. depth moulded. She is built on fine lines, and will have a carrying capacity of over 4,100 tons of tea. She has long bridge; T. G. forecastle, and short hood aft for protection of steering gear, accommodation for her officers and engineers being arranged under the bridge; water ballast in double bottom in after hold and under engines; teak decks, especially strong, and ample cargo discharging gear, make her a ship especially adapted for this particular trade. But the most important feature about this vessel is the engines with which she has been fitted, by Messrs. Thos. Richardson & Sons, of Hartlepool, on the triple expansion patent by Mr. Wyllie. These engines, with a boiler pressure of 140 lbs., working direct on three cranks, are capable of developing 1,600 I.H.P., and are estimated to drive her not less than 12 knots speed, whilst her working consumption will not be more than 16 tons per day, an expectation which is justified by the practical working of similar engines of steamship *Jacatra*, built and engined by the same firms 12 months ago, and which have shown a proved economy of over 30 per cent. in consumption. Her trial trip proved in every way eminently satisfactory. The engines, which owing to their working direct on three cranks are marvellously steady in movement, worked without the slightest hitch, and gave a speed of 12½ knots, which could be maintained with the greatest ease. The vessel is commanded by Captain MacHugh, under whose supervision she has been fitted out, with Mr. Mickelreid as consulting engineer for the owners.

Eldorado.—On May 16th the steamer *Eldorado*, built and engined by Messrs. Earle's Shipbuilding and Engineering Co., Ltd., Hull, for Thomas Wilson, Sons & Co., of the same town, was taken on her official trial-trip on the measured mile off Withernsea. The vessel is classed A 1 in the Liverpool Registry. Her dimensions are: length, 235 ft; breadth, 30 ft.; depth of hold, 15 ft.; and being intended exclusively for passenger traffic, is designed with very fine lines, and the utmost available space has been set apart for passenger accommodation. She has a long, full poop, and topgallant forecastle, the engines being placed as far aft as possible: the whole of the first class accommodation is thus provided forward of the engines and boilers under the poop. A large iron deck-house is fitted on the poop, containing saloon entrance, music, smoke, and chart-rooms, and wheel-house, and the top of this house, together with the poop-deck, will afford a spacious promenade. The whole of the ship is lighted by electricity. There is sleeping accommodation for 86 first class passengers. The watertight bulkheads have been constructed so as to ensure the safety of the vessel as far as possible, in the event of collision. The collision bulkhead is designed with a conical form, and is unusually strong, in order to resist pressure in case any damage is done to the bow. A small water-ballast tank is fitted forward for trimming the ship, and she is rigged as a schooner with three pole-masts. The 'tween decks forward will be arranged for carrying emigrants. She is fitted by the builders with their triple-compound three-crank engines of 300 N.H.P., having cylinders of 26 in., 40 in., and 68 in. diam., and 39 in. piston stroke, supplied with steam of 150 lbs. pressure, from two large steel boilers, each fitted with four of Foxe's patent corrugated furnaces. The speed attained on the measured mile was 14·43 knots, notwithstanding the rough state of the weather. It is expected that under more favourable circumstances, and in better trim, she will steam about 15 knots. The *Eldorado* left Hull for Bergen, on the 26th May, on her first voyage.

Steel Paddle-wheel Steam Launch.—On May 16th the steel paddle-wheel steam launch, 65 ft. long by 11 ft. broad, and 18 in. draught of water, lately launched by Messrs. Matthew Paul & Co., Dumbarton, and built and engined by them to the order of Messrs. P. McIntosh & Sons, Glasgow, for the Indian Government, under the superintendence of Messrs. MacNicoll and Co., consulting engineers and naval architects, Glasgow, went on her official trip with a large party of ladies and gentlemen. Owing to the rough weather, it was not thought advisable to go to the Wemyss Bay measured mile with such a light draft craft, having only open bulwarks; but her power and speed were abundantly shown on her way to the Gareloch against a strong head-wind and heavy sea, which also thoroughly tested the rigidity of her construction, and the substantial nature of the fittings. She has teak-house forward, with large saloon, pantry, bath-room, &c., all fitted up in a substantial manner. The deck and fittings throughout are all of teak. The engines are fitted with Messrs. Paul's patent valve gearing and reversing motion, the advantages of which were satisfactorily proved during the trial. All concerned returned with the vessel to Dumbarton highly pleased with the results attained.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—ED. M. E.]

THE POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—Your correspondent, T. C., in the May number of THE MARINE ENGINEER, would have been perfectly justified in pointing out any discrepancy in my letter which appeared in the April issue if any such discrepancy existed. I am perfectly acquainted with Clause 13 of the Merchant Shipping Amendment Act, 1862, to which he refers, and, after quoting it, asserts "*so that a fireman or trimmer cannot, by any amount of service as such, develop into a full-blown engineer.*" In making that assertion, T.C. is labouring under an error, that can easily be dispelled by a very slight investigation. I maintain that firemen, donkeymen, &c. have obtained certificates of competency, though not possessing the slightest practical knowledge, and are recognised in the trade as shovel engineers. I grant they raise themselves, but fail to see in what manner they raise the profession. And T. C. has failed to afford any information on the subject.

In paragraph 3 T. C. says—"That many chief engineers leave the management of the engine room, as far as repairs, &c. are concerned, to the second and third engineers, *the chief's time being fully taken up with visiting and shore going.*" If the chief has competent men under him (not shovels) who execute his orders, and are able to maintain he efficiency of the engines, I do not see that T. C. should find fault with a little relaxation, knowing all the responsibility of the engine room still rests in his hands.

T. C. further asserts "*that steamship owners value their services lightly, and regard them as white elephants saddled on them by the Board of Trade.*" That statement is such an insult to the class to which T.C. evidently has not the honor of belonging, besides being an untruth, that it needs no comment.

T. C. again deviates from the path of rectitude in saying that

"*engineers persistently ignore the authority of the Captain.*" From whom, sir, they receive all orders. Thereby acknowledging his authority. Chief engineers should feel deeply grateful to T. C. for his advice to them, to "*comport themselves as gentlemen.*)" I am not aware they do not. Relative to his (T.C.'s) remarks on Diagrams "*used for covering the neglect of the engineer,*" "taken by the score"! "*and reserved for use: old ones slightly manipulated!*" this is another charge that is condemned by its own absurdity.

T.C. suggests that "*each vessel be compelled to carry an Indicator. Diagrams to be taken by or under the supervision of a Board of Trade Surveyor.*" During some 18 years' experience I have always been supplied with an indicator, and took a set of figures (not a score) when necessary. Diagrams are not such a novelty as T. C. seems to imagine, so we do not require the "*supervision of a Board of Trade Surveyor*" to take or read them.

Granted that the "*Engineer has before him a great future*"—it behoves us all to see competent men in the profession only, and that can be accomplished by granting certificates of competency to none but those who can show proof of having received such practical training that is eminently necessary to qualify them for the position of.

MARINE ENGINEER.

To the Editor of THE MARINE ENGINEER.

SIR,—I have read in your May issue the letter of T.C., on the position of marine engineers, and while agreeing with him on some points, there are others that I don't agree with.

1st. I maintain that all sea-going engineers should be practical men, who have served an apprenticeship of five years at the making and repairing of marine engines.

2nd. That the present amount of sea time required by the Board of Trade is quite sufficient to qualify for a first-class certificate, provided an apprenticeship of five years has been served. If a man with seven years' practical experience cannot so far master the steam engine as to be able to take charge, he must be without the average amount of intellect.

3rd. "The custom of many chief engineers, leaving the management (as far as repairs and examination is concerned) to the second and third whilst in foreign ports," may be true in a great many cases, still I believe that the majority of chiefs do look after their jobs. If the second and third are not qualified to do the repairs, they are not fit for their positions.

4th. The disagreeableness often existing between the captain and engineer is generally attributed to the former. No engineer who knows his own place will doubt but that the captain is commanding officer; at the same time captains should bear in mind that engineers were not brought up in the forecastle, and treat them as gentlemen, and not be too over-bearing with their orders, such as (for instance) wanting steam on the main boilers, at once, (to work cargo) when they are under repair. Captains should remember that the engineer has got his certificate to look after as well as he, and the only opportunity for properly cleaning and repairing the boilers is when in port. They should both try and pull together for their own comfort and their owner's interest.

5th. As regards the extra grade I may say that it is not necessary; also that few of our sea-going engineers have received a sufficient technical education to enable them to pass for extra. A shipowner will not give more wages simply because you have got an extra certificate, and "practical" not "technical" is the education required for the sea.

6th. I don't think that the age necessary to qualify for a second-class certificate should be raised to twenty-four years. Captains and mates are allowed to pass at an earlier age, and they have the safety of the ship and lives in their keeping as well as the engineers. As regards the greater demand for second-class engineers, I think it is partly to be accounted for by the fact that under power jobs only require to carry a second; whereas if a first was required as well as a second, the demand would be greater. The only difference I see between an engine of 98 H.P. and one of say 120 H.P. is simply that it is on a smaller scale, and the risk may be smaller but still there is risk.

If the Board of Trade should not do away with the above arrangement, is should at least insist that all engines are registered the power that they actually are, as I believe there are a great many "big 98's" afloat.

In conclusion, I think it is a mistake on the part of the Board of Trade to grant certificates in steam to captains, as it makes them fancy that they know more than they really do, and lowers the position of the engineer. They may as well grant certificates in navigation to engineers, as they are more qualified to pass in navigation than captains in steam.

Hoping I have not taken up too much of your valuable space, and that others of your readers will express their opinions,—

Yours truly, G. W. S.

Miscellaneous.

FOG SIGNAL FOR THE TAY.—Messrs. Steven and Struthers, Glasgow, have just received an order for a fog signalling apparatus, which is to be fitted on the lightship *Abertay*, situated near the mouth of the Tay.

THE Cockerill Company will at the end of this month launch from its shipbuilding yard, near Antwerp, a swift steel screw steamer, built for the Belgian Government to watch the North Sea fisheries and to train Belgian sailors.

STEAM SHIPBUILDING IN NEW ZEALAND.—Messrs. Kincaid, M'Queen & Co. have undertaken the construction of a steel screw steamer for the Dunedin and Invercargill trade to the order of Mr. Keith Ramsey and others, and the work will be commenced immediately upon the arrival of the material from England. The contract specifies that the steamer shall be built entirely of steel, under special survey, and classed 100 A at Lloyd's. The principal dimensions are as follows: Length of keel, 127 ft.; length over all, 135 ft.; breadth of beam, 9 ft. 2 in.; depth of hold, 8 ft. 6 in. She is to be fitted with a pair of compound direct-acting surface condensing engines, indicating 250 H.P. The diameter of the cylinders will be 18 in. and 33 in. respectively, having a stroke of 21 in. The boiler is to be of mild steel, 10 ft. 6 in. in diameter, and having a working pressure of 80 lb. to the square inch. Messrs. Kincaid, M'Queen & Co. have seven months in which to complete the contract.

IMPORTANT SHIPBUILDING CONTRACTS.—Some days ago Messrs. Robert Napier & Sons booked an order from the Eastern Extension, Australasia, and China Telegraph Company to supply a steamer in place of the *Magneta*, a telegraph ship which was recently lost in the Bay of Biscay, on her first voyage. She is to be built of Scotch steel. Since that order was booked another has been secured by Messrs. Napier & Sons for the same company. The second vessel will be generally similar to the *Magneta*, but 23 ft. longer, making her 253 ft. in length. Messrs. Russell and Co., shipbuilders, Greenock, have lately booked several orders for sailing ships for Clyde owners, three of them being for Messrs. Peter Denniston & Co., of Glasgow; two ships, of about 1,200 tons each, for Messrs. J. & W. Crawford, Greenock; and one for Messrs. Kerr, Newton, & Co., Glasgow. The aggregate of the six vessels will be over 7,000 tons, and several of the keels are to be laid down in the builders' Greenock yard. The prices for the new vessels are said to be the lowest ever current.

THE Executive Council of the American Exhibition, after examining the merits of various sites, has given the preference to that of Earl's Court, Kensington, in proximity to the site of the South Kensington annual exhibitions, and of equal area, about 22 acres. The American Exhibition will have its own railway station in its own grounds, and be in direct communication with all the railway systems of the United Kingdom.

HER MAJESTY'S sloop, *Mariner*, has arrived at Queenstown from Devonport, in company with Her Majesty's ships *Conquest*, *Racer*, and *Mercury*. The vessels are on their trial trips, and are ordered to cruise on the south-west coast of Ireland. The *Mariner* attained a speed of 12 knots per hour in the run from Devonport, and her engines answered satisfactorily.

MESSRS. DONALD CURRIE & Co.'s steamship, *Garth Castle*, Captain R. Duncan, and the P. and O. steamship *Chusan*, Captain H. Wyatt, arrived in Plymouth Sound on May 19th, within one hour and a-quarter of each other after an exciting race across the Bay of Biscay. It appears that after passing Cape Finisterre the *Chusan* sighted the *Garth Castle* steaming ahead of her. She at once put on all steam and raced up to the *Garth Castle*, and the two vessels then made a fair start for Plymouth. There was great excitement on board the two ships and a large number of bets were made. The pair kept well together up to Sunday night, when the *Garth Castle* went ahead, arriving at the Eddystone forty-two minutes before the *Chusan*, and anchoring in the Sound one hour and a-quarter ahead of her. It was stated by some of the passengers that at one time the two vessels were so close to each other that bets were made between passengers of each ship. This must have been a lively time for engines and engineers and stokers.

THE *Polyphemus*, which will be ready for the trial of her machinery next week, is to be fitted with two five-barrel Nordenfelt guns instead of the two Gardners previously ordered. She is also being provided with torpedo nets.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from April 13th to May 19th, 1885.

4552 J. Barrett. Rowing boats.
4569 A. McDougall. Construction of boilers.
4570 W. P. Sayers. Rotary engines and pumps.
4581 Colton (G. Schuhmann). Steam engines.
4620 J. Gresham. Feeding water to steam boilers.
4640 J. Bird. Automatic governor.
4642 J. Tennant. Lubricator.
4648 Johnson (E. Korting). Steam pumps.
4649 J. D. Jack. Steering gear for fishing boats.
4655 J. Paton. Lubricating.
4665 J. N. Wilson. Stoking boiler.
4666 J. S. Booth. Boiler and other furnaces.
4678 R. Dalgleish & T. Claridge. Steam boilers.
4705 J. Horne. Valve and float.
4711 M. Keenan. Protecting boilers against radiation.
4715 Johnson (N. Yagn). Screw propellers.
4719 Lake (G. H. Nye). Steam vacuum pumps.
4725 H. Dansey & O. Robinson. Compound engines.
4741 J. Hick & J. F. Phillips. Rotary engines.
4779 G. F. L. Davis. Marine screw propellers.
4784 J. Belduke. Screw propellers.
4797 J. & S. Smith. Safety steam valves.
4800 J. G. Jones. Governing the speed of steam and other engines.
4803 J. H. Dewhurst. Low water safety valves.
4842 R. E. Dickenson. Rotary engines.
4860 J. Derry. Differential balance gear.
4864 J. Etherington. Lubricator.
4867 C. Oertling, H. Sauber, & G. Ludwig. Utilising exhaust steam.
4910 A. Payne. Steam engines.
4965 J. Broadfoot. Ships' pumps.
4966 ,, ,, ,,
4970 H. H. & G. H. Taylor, & J. Bates. Steam valves
4995 J. McConnell. Governor for steam engines.
4996 W. H. Gales & T. Medhurst. Means for replenishing boiler furnaces.
4997 W. F. Rees. Disengaging hooks for ships' boats.
5000 V. Holliday. Packing and lubricating piston rods.
5010 Clark (M. Honigmann). Storing steam power.
5025 G. Molyneux. Propeller guard.
5040 W. H. Rodley & J. Puttrell. Taps, cocks, and valves.
5085 F. W. Crohn. Steam engines.
5088 A. J. Allan. Fishing nets.
5121 Justice (B. J. Carroll). Preventing the racing of marine engines.
5122 T. Cornish & B. Finch. War ship.
5127 W. Y. Fleming & P. Ferguson. Steam boilers.
5149 Newton (A. L. G. Dehne). Purifying the feed waters for steam boilers.
5150 G. Burnett. Governor for marine engines.
5151 J. W. H. Gray. Pumps.
5174 J. B. Moscrope. Recording simultaneously the performance of a steam engine, and the boiler pressure.
5196 C. Burnett. Governing pumping engines.
5210 J. P. Rawlings. Marine engine governor.
5247 Brunton (G. Brunton). Centrifugal pumping apparatus.
5257 Jensen (The V. Stöberdog Mekanisk Verksted). Lubricators.
5258 C. R. Parkes. Protecting vessels from torpedoes.
5263 C. A. McEvoy. Mines and torpedo apparatus.
5287 A. Maclaine. Piston and valve rod packing for steam engines.
5326 Lake (D. P. Dobbins). Lifeboats.
5334 J. Brown. Steam steering gear for vessels.
5336 H. P. Fenby. Rotary engines and pumps.
5351 J. M. Hall. Rotary engines.
5394 J. Fyfe. Securing non-conducting materials to boilers.
5325 A. Farquhar. Metallic packing for piston rods.
5401 S. Schatzky. Steam boiler apparatus.
5416 R. Wagstaff. Rotary pump.
5444 E. J. Hill. Boat lowering tackle.
5445 ,, ,, ,,
5446 C. J. Bates. Cock.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

April 18th, 1885.

Black, Dugald ..	1C	Glasgow
Black, John	1C	,,
Christie, R. B. ..	1C	,,
Cross, J. A.	2C	Hull
Davies, James W.	2C	Liverpool
Fleming, M.	1C	Glasgow
Forshaw, J.	1C	Liverpool
Girvin, J. L.....	2C	Glasgow
Hitchcox, E. J..	2C	London
Kerr, D.	1C	Liverpool
Kitching, A.....	1C	Hull
Lagan, Geo.	1C	Glasgow
Leighton, H. ..	1C	N Shields
Love, L.........	1C	Glasgow
Mackie, A.......	2C	,,
McColl, H.	1C	,,
McKeivie, A. ..	1C	,,
Murray, J.	2C	W H'pool
Rincaird, E. E..	2C	London
Rodger, J.......	2C	Glasgow
Seaton, W. T. ..	*Ex* 1C	Hull
Sim, Geo.	1C	Glasgow
Smithson, A. E..	2C	N Shields
Spink, C.	1C	Hull
Storm, Alex.	1C	W H'pool
Toddie, Wm. ..	1C	Glasgow
Winter, James ..	2C	Liverpool

April 25th, 1885.

Aikenhead, C. W.	2C	N Shields
Barnes, Robt. G.	1C	Cardiff
Bird, H.	2C	N Shields
Carson, T.	1C	Glasgow
Copland, C. C. ..	2C	N Shields
Evans, J.	2C	Cardiff
Flett, Robt.	2C	Glasgow
Fraser, D.	2C	N Shields
Garrick, J.	1C	Glasgow
Gilchrist, T. A..	2C	Hull
Globs, G.	2C	Cardiff
Graham, J. R. ..	2C	W H'pool
Gravesen, Edwd.	2C	N Shields
Harrison, Richd.	2C	,,
Hill, W. H.	2C	Cardiff
Jack, Peter	2C	N Shields
Kidd, Alex.	1C	Liverpool
Lübbers, F. W..	2C	Cardiff
Lowe, W.	2C	,,
McConochie, R.A.	2C	,,
McKenzie, Peter	2C	London
McFie, A.	2C	Greenock
Nairn, G.	2C	Glasgow
Nicholary, N. ..	2C	N Shields
Peacock, G.	2C	Glasgow
Pirie, W. W. ..	2C	Aberdeen
Pottie, Wm.	2C	N Shields
Price, Wm.	2C	Cardiff
Ritchie, Robt. ..	1C	,,
Robertson, J. M.	2C	Liverpool
Scott, C. D.	2C	Hull
Smith, Geo.	2C	Glasgow
Smith, T.	1C	Cardiff
Thomas, J. R. ..	1C	,,
Thomas, W. T..	1C	,,
Tossell, H. P. ..	2C	Hull
Williams, J. G..	1C	Cardiff

May 2nd, 1885.

Addison, G. R. ..	2C	Snderland
Brockbank, John	2C	Liverpool
Cameron, John ..	2C	London
Cope, R. & J. ..	2C	,,
Crighton, G.	1C	Snderland
Dunbar, Alex. ..	2C	Liverpool
Edwards, Chas. B.	2C	Plymouth
Gibson, J.	2C	Snderland
Gilchrist, W. ..	2C	London
Hollingsw'th, J H	1C	Snderland
Horn, Wm.	1C	London
Johnson, J.	1C	Liverpool
Lambert, J.	2C	Snderland
Lanigan, Ed. ..	2C	Glasgow
Lee, J. C.	1C	Dundee
Lochhead, J. M.	1C	Glasgow
Lyme, Henry ..	2C	Liverpool
Marshall, John ..	1C	London
McConochie, C..	2C	Bristol
McCreath, James	1C	Glasgow
McLachlan, H...	1C	,,
Mills, Edwin ..	2C	Plymouth
Nichol, J. W. ..	2C	Snderland
Nicoll, D.	1C	Dundee
Reid, James C..	2C	Glasgow
Reid, John C. ..	2C	,,
Stitt, John	1C	,,
Wain, Thomas ..	2C	,,
Watson, J. J. ..	1C	Snderland
Weir, John G. ..	2C	Glasgow
Wilkins, T. F. J.	2C	Bristol

May 9th, 1885.

Anderson, J. G..	2C	Liverpool
Cameron, John ..	2C	London
Constantine, Rbt.	1C	N Shields
Dale, Stephenson	2C	,,
Fenner, R. D. ..	2C	,,
Greaves, James..	2C	Liverpool
Green, J. V.	1C	,,
Harrower, J. G.	1C	Greenock
Lillico, Wm.	1C	N Shields
Mathias, J. R. ..	1C	Liverpool
Phillips, Stephen	*Ex* C	Swansea
Rams, W.	2C	N Shields
Reilly, James ..	2C	Liverpool
Sibbitt, J. T.....	1C	,,
Whaley, H. A ..	2C	N Shields
Wilkinson, F. W.	2C	London
Wilson, C. G. ..	2C	Liverpool

May 16th, 1885.

Armour, Richard	1C	Dublin
Boyling, Chas. H.	2C	Liverpool
Cameron, John ..	1C	N Shields
Campbell, Francis	1C	Glasgow
Campbell, Hugh	1C	Leith
Carmichael, Hugh	2C	,,
Devling, Wm. ..	1C	Glasgow
Ditchburn, Robt.	1C	London
Dudgeon, David	2C	Glasgow
Farthing, Jas. C.	2C	London
Fleming, John ..	2C	Glasgow
Forrest, Thos. ..	1C	Leith
Fraser, Jas.	1C	Glasgow
Gemmel, Jas. ..	2C	,,
Gordon, F. H. ..	1C	Leith
Jones, Herbert ..	2C	Glasgow
Kemp, Benj.	1C	,,
Mackie, Andrew	2C	Leith
McIver, John ..	1C	London
McLean, Martin	2C	Glasgow
Pearson, G. H..	1C	Leith
Robinson, A H M	2C	London
Russell, James ..	2C	Leith
Stalker, Peter ..	1C	Leith
Stokes, Walter J.	2C	London
Tweedley, Wm..	2C	Liverpool
Wiggins, T. W..	2C	Glasgow
Williams, A. A.	2C	Liverpool

The Marine Engineer.

LONDON, JULY 1, 1885.

EDITORIAL NOTES.

MILD steel plate has again scored an enormous success as compared with iron, for use in ships' hulls, though it has arisen from an incident which can scarcely be termed other than deplorable. The *Leander* is a perfectly new ship on its first cruise with the Evolutionary Squadron, her hull being built of mild homogeneous steel plates throughout. She has had the misfortune, on returning from her evolutions at sea, to strike upon a sunken rock in Castletown, Berehaven. With an iron ship the consequences of the shock would probably have been sufficiently disastrous to have sunk her, as the plates were bulged, and rows of rivets were sheared clean off. In her case we are happy to announce that no actual fracture was made in the tough plates of her bottom, and therefore nothing more serious followed than a leak, which the condenser and fire-engine pumps were able to deal with. It seems, however, that the transverse bulkhead which separates the fore stoke-hold, where the double bottom begins from the forward compartment of the ship, has been so wrenched and twisted by the shock, that some serious amount of repairs will be necessary before she can again be rendered seaworthy. It is probable, as soon as she has undergone a preliminary examination, and any temporary repair that may be considered necessary, that she will go into Pembroke Harbour to be docked for repairs. Although these instances are of the greatest utility in teaching us the reliability, or otherwise, of the materials and design of which our ironclad Navy is constructed, yet it cannot but be felt that the constant mishaps attending the evolutions of our ironclads, point to some essential difficulty, or ignorance on the part of their captain and crews, in their management. We do not for a moment suppose in the numbers of accidents of this kind that have already occurred, or in the present case, that our captains and crews are less skilful or are more culpably careless than they used to be, and we must therefore look for an explanation of these disasters in some alteration of conditions to which our seamen and officers have not yet become accustomed. We have no evidence as yet to hand, as to how far this disaster to the *Leander* arose, whether from any failure of the steering gear, or indisposition of the vessel to answer its helm, which is by no means an unknown vagary amongst the modern ironclads. It will be interesting to note, when details are to hand, whether the adequate control of an ironclad by the ordinary steering gear and rudder is not rapidly becoming uncertain, and the conditions inapplicable to the new class of vessels. We doubt, also, whether naval officers, accustomed only to the comparatively light and handy bulk of wooden vessels, have a just realization of the enormously altered conditions of the modern ironclad, with their immense increase of mass and density. These points can only be thoroughly appreciated by lengthened experience, and we trust that the mishaps, which from time to time have occurred to our ironclad navy in these times of peace, will save many disasters, from the experience so acquired, in more critical times of war.

IT would be a pity, seeing the enormous commercial advantage given to the shipping industry by joint stock investment, were shipowners or ship managers, who derive advantage from this method of investment, to allow joint stock enterprise in shipping to acquire the same unsavoury reputation as limited liability companies have already acquired in ordinary commercial enterprise. It has lately become a practice with many landsmen, farmers, clergymen, widows, domestic servants, medical men, and others, to invest small sums of their hardly earned savings in the joint stock proprietorship of commercial steamers. And hitherto, although latterly profits have been *nil*, and losses even large on all shipping enterprise, shareholders having formerly tasted good profits, have been for the most part probably content to wait in patience for better times, so long as no suspicion of unfair dealing could arise. As most of the present class of investors have little, if any, business knowledge, and are probably entirely ignorant as to shipping matters generally, they are wholly in the hands of their managers and brokers. The responsibility, therefore, upon such managers, towards the outside shareholders, is much greater than that of an ordinary board of directors, elected from the body of the shareholders themselves, and it therefore behoves such managers to regard with a careful eye the interests of their shareholders thus implicitly placed in their hands, unless they desire this line of investment to stink in the nostrils of the public. We are sorry to see that even now an important action is pending against certain shipowners and agents, for alleged fraudulent dealing with the assets

and profits of their joint stock co-proprietors. We trust, for the sake of the shipping interest at large, that even this case will turn out to be much exaggerated in its alleged statements, and should it prove to be too correct, that it is but an isolated case amongst the usually well conducted and respectable enterprises of this class.

In spite of the enormous reputation that the Americans have acquired for originality in engineering design and construction, we find that our former anticipations that they might with advantage take a lesson from English marine engineers for the construction of their navy, is now being supported by results. One of the first products by Mr. Roach, from the designs of the American Naval Advisory Board, towards the new iron-clad navy which is about to be constructed, is the dispatch-boat *Dolphin*. A good many of the facts are kept as quiet as possible, but there seems to be little doubt as to the result of the trial trip. It seems that Mr. Roach bound himself to run the engines of the *Dolphin* for six hours, and to indicate during that time not less than 2,300 H.P., which has not been realised. As the entire object in the design of the *Dolphin* was speed and endurance, to enable her to furnish rapid communication from the Seat of Government to any point on the coast or the West India Islands, or to act as a fleet dispatch-boat or flag-ship, it is not surprising that critical tests as to her speed and wearing capabilities in a long run should be exhaustively carried out. These results, it is understood, have failed dismally to come up to expectation, and there now remains a knotty point of dispute as to who may be liable for the mistakes, viz.: the contractor, or the Advisory Board who has controlled his designs and construction. We must confess that our sympathy lies with the contractor, Mr. Roach, since he seems to have been tied throughout by the plans and specifications of the Navy officers of the old Advisory Board, for dimensions of the hull, engines, boilers, and propeller, were fixed for him and beyond his control. Under these circumstances we cannot understand how a contractor of Mr. Roach's experience could in any way have made himself liable for the results, and if he has done so, he has only himself to thank for his position. The old Navy Advisory Board had a very anomalous position, as it consisted of members who, whatever their theoretical capabilities, were almost entirely without practical experience in the designing or building of engines and boilers. Were this Board to confine itself to the checking and superintendence of specifications and designs, or the compilation of the best results attained by those who are already masters in the art of engine design, its services no doubt would be very valuable in regulating the designs for a new Navy to be constructed in the States. When, however, such a theoretical and amateur Board take upon themselves to strike out entirely new lines of construction in all details, both of the hull, engines, and boilers, their conduct certainly verges upon arrogance and brag, which is frequently so unpleasant an accompaniment of our American Cousins' "go-a-headism." When the States could have had all the advantages of the many years' experience of this country in ironclad building and engineering, and when we have before us such successes as the *Esmeralda* and *Riachuelo*, the blindness of the American Navy Board is almost inconceivable. However, experience must usually be dearly bought, and we trust that that now acquired will bear good fruit over the water, as we should be glad to see the Americans possessed of a fine and powerful navy, proving, as it might, a most valuable ally to ourselves, were the Anglo-Saxon race ever to have a struggle for their existence.

It is strange and interesting to note how much the policy and even existence of nations depend, more and more, upon the constructive abilities of marine and other engineers. It is probable that to Messrs. Yarrow & Co., of Poplar, will belong the credit of effecting at some early date that which the retiring Liberal Government have found themselves unable to do. Should the portentous prognostications of Lord Wolseley, that the Mahdi will appear with his followers at the boundaries of Egypt wherever they may be fixed, be fulfilled, this country will chiefly have to depend for his effective repulse upon the three fighting stern-wheel boats which are now being constructed by Messrs. Yarrow & Co. We should imagine from the description of these boats that the Mahdi or any other invader would find them very awkward customers to tackle, unless provided with very heavy guns. These steamers are 100 ft. long over all, and 18 ft. wide, and are provided with a main and upper deck. The vessels draw in fighting trim 2 ft. 2 in., and are propelled by a single stern wheel, 12 ft. in diameter, fitted with 11 radial floats. The engines are horizontal and compound surface condensing, placed on either quarter, and have cylinders 11½ in. and 20 in. diameter, by 3 ft. 6 in. stroke. The boiler is placed forward and is of the locomotive type, working under ordinary circumstances at 160 lbs. pressure, but with a forced draught the pressure may be raised to 190 lbs. The fighting armament is a nine-pounder steel gun, mounted on the upper deck as far forward as possible, and four Nordenfelt guns, two

placed aft, and two amidships, provided with protecting screens of steel. On the lower deck forward there is a circular battery of steel plates, more than sufficient to stop rifle fire, large enough to hold eight men, and provided with slotted holes for rifle fire. To facilitate export and launching, these vesssls are built in nine distinct sections, each of which is floatable in itself. These sections can be rivetted up complete before export, and have only to be bolted together to form the complete boat. This is evidently an extremely convenient arrangement, and affords a further advantage of a perfect division of the whole into nine watertight compartments, each separated from its neighbour by a double bulkhead. It will be a matter of much interest to us to watch the performance of these little ironclads should the Mahdi be obliging enough to give us the opportunity.

ONE of the great questions of modern warfare that will remain without a satisfactory answer until tested by some general naval engagement, is the importance, as an offensive or defensive weapon, of the modern torpedo. Opinions are much divided upon this point. Some eminent naval authorities have gone so far as to say that ironclads cease to be of any practical value in the face of the modern torpedo. On the other hand, at least, one eminent naval authority, Hobart Pasha, has declared that the value of the torpedo as a weapon of offence and defence has much been exaggerated, and in so far as Hobart Pasha has seen more practical experience in torpedo warfare than any other naval officer afloat, his opinions should be of great weight. We fear, however, that Hobart Pasha's opinion depends entirely for its importance upon the torpedo boats, as at present constructed. For instance he considers that a squadron of ironclads is amply protected from night attacks by torpedo boats, when surrounded by a steel chain, attached to, and supported by small boats at a distance of, say 500 yards radius from the squadron. This estimate of safety, however, depends entirely upon the present fact that the limit of range of a Whitehead torpedo is about 400 yards, and any improvements increasing materially the range of the torpedo (as is reported to be the case with that of Brennan) up to 1,000 yards, would at once render the squadron vulnerable from the exterior of the defensive circle. Hobart Pasha also founds his opinion on the comparative inoffensiveness of torpedo boats, except within small ranges of the shore, from the fact that he considers torpedo boats unreliable in heavy weather and not capable of making a long run from land. These objections no longer exist where the torpedo boats are carried as adjuncts or tenders to larger vessels, such as the *Hecla*, from which they can be put off at any time for their destructive operations, and can return for replenishment of their coal bunkers, or missiles, or other exhausted material. As there is so much to be said on both sides as to the value of torpedoes and torpedo boats, as weapons of offence, intense interest will attach to their first employment on a large scale in a naval engagement.

TORPEDO WARFARE.

THE Evolutionary Squadron, under the command of Admiral Sir G. Hornby, which has lately been defending Berehaven against torpedo attack, although performing many, if not all, of the ordinary summer manœuvres of our fleet, is possibly the first squadron which this country has ever sent to sea to put to the test—if such manœuvres can do it—the highly estimated, and possibly exaggerated, nature of torpedo boats as weapons of attack upon coasts and harbours. These dangerous little craft are said to be of a sea-going type: they were, it was said, when they were built, capable of steaming round the island; and although not so large as others which are at present in the hands of the builders, they are the only sea-going boats which the Admiralty have, so far, in commission. They may be said, without exception, to fairly represent, in their powers to go to, and keep the seas of the Channel, the torpedo craft of other European nations, at present afloat, or of all other distant countries which have lately been adding torpedoes to their navy. On Tuesday morning, June 9th, this powerful and splendid-looking fleet of ships came out of Portland, and steamed quietly and slowly into the Channel, when signal was made from the *Minotaur* for the ironclad ships to form into columns of divisions, and under easy steam. The first division included the *Minotaur*, *Polyphemus*, *Shannon*, and *Lord Warden*; the second, *Agincourt*, *Hotspur*, *Devastation*, and *Iron Duke*; third, *Hercules*, *Ajax*, and *Sultan*. The *Mercury*, *Conquest*, *Racer*, and *Mariner* had already gone on ahead to Bantry Bay. Immediately on leaving Portland, and on getting into the Channel, the Cunard *Oregon* was seen approaching at the top of her speed, and, in passing the fleet, saluted the admiral. She was told off to wait behind for mails and despatches. On the fleet's arrival at Bantry, arrangements were at once made for the defence of the harbour and landing places, also for the channels, through which alone such places could be attacked by a superior fleet. These operations, in the main, consisting of forming a boom of spars across the channel, to which every vessel had to contribute her topgallant masts, and other such floating gear.

Defensive works of this nature, called "zarebas," after the forts in the Soudan, were also used for the protection of the fleet, and the whole kept together by heavy wire hawsers of 14 in. in circumference. Two passages had to be blocked by such booms, and the bottoms sprinkled with submarine mines. One passage was narrow and easily blocked, but the other passage, called the eastern entrance to the anchorage, was the reverse of this, and taxed all the resources of the fleet to make the necessary preparations against an attacking force. The object of this paper is, however, to follow more the movements of the torpedo boats, rather than the further manœuvres of the fleet. Soon after leaving Portland, although the weather was correctly described as "beautifully calm and fine, with smooth water," a rather unexpected opportunity occurred of testing the sea-going qualities of these dangerous little craft, which, in the opinion of many excellent judges, are going to do so much in changing the aspect of all naval wars. Torpedo boats of this class may yet do all that has been claimed for them, and much more. They may succeed in blowing into *thin* air the most effective and costly of ironclad fleets, and in sweeping the Channel and all other seas of everything in the shape of a ship; but three out of the eight of them which started away with the squadron would quickly have been destroyed had the big ships been intent on such business. As it is, they have disappointed their most ardent supporters, and fulfilled, to a certain extent, much that competent admirals and other naval commanders like Hobart Pasha have predicted for them, before they had been four hours at sea. Their

enormous speed of twenty-five miles an hour, which has been done in smooth water, was, in the "calm weather of the Channel," reduced to something in the shape of a breakdown, and this, according to an apparently well-informed eye-witness, more to "head seas" than to any defect of machinery.

Although the weather was described as "fine and calm," perhaps some allowance should be made for inexperienced people standing upon the decks of a high-sided ship, whence the sea, which is high and lumpy enough for small boats, appears smooth and pleasant to an observer. The probability is that, with the ever-running westerly swell, and but just a moderate head wind, the sea was heavy enough to nearly swamp an open boat, running into it at twenty or twenty-five miles an hour. There was also a great deal of water flying over the bows continually, and, probably, much racing of the propeller. But twenty knots an hour in the quiet waters of the Thames, is a very different thing to the same high speed in the open Channel, which, although generally much too rough for any such navigation, is, even in the calmest weather, nearly always disagreeably affected by the effects of wind. Having, so far, this little experience before us, it may certainly be doubted whether these small craft may ever be depended on to make a reliably fast passage round the coast; for in summer, as in winter, storms and winds too strong for them are common enough. With the wind at full force five, and when a fast armoured ship could comfortably do her fifteen or sixteen knots in the wind's eye, these little craft could never approach her from to leeward, or from any point with the sea against their course. Neither could they—judging from what we have long known of the abilities of small steamers to make headway against wind and sea—escape from the fire of a hostile ship, which, with a speed of fifteen knots, happened to be to leeward of them.

Under such disadvantages, armoured ships, and fleets having high speed, may afford very much to laugh at many of the terrors which have been so industriously illustrated for their comfort. As observed in the run across to Ireland, the waves breaking over the bows during the night, and the tell-tale trail of smoke, would speedily betray their presence to the sleepiest of enemies. Perhaps the difficulty of smoke, hand-picked Welsh coal, or other "resources of civilisation," might be left to grapple with; but the chances of eluding the eyes and teeth of Nordenfelts, and other machine guns, would be small, indeed, in rough weather. There is every reason to suppose, along with Admiral Hobart Pasha, who, perhaps, knows as much about torpedo boats as any other naval man, that such things as weapons of attack have been very much overrated, and this opinion becomes the more confirmed as our knowledge of their abilities increases.

What surpassing stage of perfection and destruction we may ultimately arrive at in this weapon, and, perhaps, within a very few months, no man can say, for already there are reports of greater wonders in the air. After many unsuccessful attempts at inventing a balloon for navigating the heavens at the will of its commander, an enterprising American has succeeded in producing a machine of this order, which will propel itself at the rate of thirty miles an hour, "dead to windward"—a flying torpedo, which is said to be able to destroy at will, not only fleets and armies, but those people and cities which they are intended to protect.

The Russian operations on the Danube, seven years ago, consisted, in some measure, of torpedo attacks upon the Turkish fleet, and other single ships; but further than planting a torpedo against the side of one of the Turks, the Russians accomplished nothing, when we come to consider what resources they had of this nature, and the command they had of the services of hundreds of bold seamen. The sinking of two of their torpedo boats by the guns of Hobart Pasha, perhaps, cooled their ardour in this direction; but, whatever the cause, the results from torpedoes may be said to have been barren indeed. This new American engine of destruction—a torpedo balloon—if not like that other balloon that was going to cross the Atlantic, may possibly revolutionise a revolution already committed, for what can avail all your ironclad fleets, when powder-magazines are sailing about over head, and dropping some tons of gun cotton upon their decks? But, until we hear more about such balloons, we may be content to address ourselves to things that are. It would appear to be evident that, as long as we "go in" for torpedo boats, if we want them to make a passage along the coasts, their size will have to be increased. They are such a cheap and powerful weapon of defence, compared—their cost—with armoured ships, that there is no reason why the country should not be provided with some, especially for the defence of harbours, and others as cruisers, big enough, when occasion demands, to run, in any weather, all round the country, and to whatever point an enemy may address himself. Vessels of about 150 ft. in length, or from that to 200, with a corresponding beam, and a depth shallow enough to admit them into bar harbours, if possible, at any time of tide, they should carry at least six days' coal at a half-speed of fifteen knots, and three days' coal at full speed, or as near to this as matters will permit. Their crews should be not less than ten men, including officers. It is somewhat singular why the Admiralty have been so backward in adopting vessels of such dimensions, for they should have known, or their naval constructors should have been aware, that steam launches under 100 ft. length, although fast enough in smooth water, can do little or nothing in a head sea. Independent of that knowledge in this connection, which instinct, nearly, should point out to a naval constructor, if nothing else did, in the shape of experiments our Admiralty-yard officials have had lessons enough from neighbouring States. Nearly ten years ago, Admiral Porter, of the United States Navy, conducted experiments of this order on his own individual account, in Chesapeake Bay. In his trials of speed in rough or short jubbly water, he discovered that for every 10 ft. of length he gained seven-tenths of a knot in speed. The outcome of this was, that while our torpedo boats were averaging about 80 ft. in length, the United States Government were building the *Alarm*, designed by Admiral Porter, and with a length of 140 ft. over all, on the deck line, or 172 ft. extreme, counting her long ram-like stem and 18 ft. of torpedo cylinders. The vessel was fully described in the papers of the day. Her displacement was 700 tons. It is doubtful whether the boat accomplished as much as our smaller boats in smooth water, but that she would have beaten them in ordinary rough weather is certain. As to the "diving," and "smothering themselves with foam," which has lately been reported of our Evolutionary Fleet, and of which a strong point has been made, it amounts to nothing as long as the boats throw off the water, and as long as their engines can stand the strain.

Such difficulties are to be expected when steaming head to wind and sea, and the faster they go the more water they will probably ship, under such conditions. Further than a fair amount of steel protection for the men, and for throwing off water, all heavy armour is to be deprecated.

The gallant fellows who will constitute their crews, and run them in their risky work of destruction, will be in no greater danger than the soldiers of all armies, in hand-to-hand fighting. They will readily, and nobly, take their chances of war, as so many gallant fellows have done before them, and would be ready to do again. What they must trust to, mainly, is craftiness and the darkness of the night, except in fleet attacks and general engagements, when torpedo boats will probably play a very conspicuous part in the winning of victories or the effacement of fleets. In the heavy, rolling smoke of a general action, they will have opportunities of making their power felt, if not on such occasions as the attack upon a single ship, in the open sea. But it would be madness for one single boat to attack a ship at any time; they must attack in dozens, from various points, either during the night or day, if they desire to be successful. For one single boat to attempt anything of this sort in the face of numerous machine guns, would be to court instant destruction.

However, all that can be said upon paper is in the nature of assumptions and suppositions; no man can do more than this, without he has had a far greater experience than any naval officer known in connection with torpedo warfare. The experiences of Admiral Hobart Pasha, of the Turkish Navy, valuable as they undoubtedly are, still will fail to guide us in the present further developed state of matters, compared with what they were during the skirmishing on the Danube in 1877. Just seven years ago, Admiral Hobart proved to the naval world that the torpedo boat could not do everything, even when backed by the most favourable conditions which their projectors could possibly demand. He proved, indeed, that if not absolutely useless on all occasions, they were, at least, on one occasion, and that was when he ran his steamer, the *Rethymo*, down the Danube, past the heavily-armed Russian batteries at Galatz, the officers of which were fully aware of his coming—saw him, in fact, through the darkness—ran over, or near to, the innumerable mines which had been sprinkled in the Channel, and also clear of the various torpedo craft which the Russians had been preparing for some time previous and for his especial benefit. Notwithstanding all these extensive preparations, he ran successfully clear of everything in the shape of torpedoes and mines, and reached the Black Sea in perfect safety, after dropping a shell into the middle of the Russian camp. This is only *another* illustration of what a swift-moving steamer may accomplish, when guided by caution and determination.

The Russians had at Galatz on that occasion—we have not

seen Admiral Hobart's book, but are quoting from memory—they had several first-class torpedo boats, one designed by Messrs. Yarrow & Co., of Poplar, and a very formidable vessel she was generally considered. She was built of steel, was dome-shaped on deck, and had great speed, with all other fittings known to naval science at that time. The Confederate Americans, in their war of five-and-twenty years ago, had a kind of submarine boat, with one of which they succeeded in blowing up a Federal cruiser, the *Housatonic* sloop of war; but from the effects of the explosion, or from some other unexplained cause, she destroyed herself in doing this, after several futile attempts, in the course of which she killed *three* crews, consisting of four-and-twenty men.

But the object of this paper is by no means to attempt to discourage the building of torpedo boats; it is rather to point out that they are not such terrible engines of destruction, as so many people think. True enough, they will do frightful havoc under certain conditions, just as the old muskets of Wellington's soldiers would, if pointed into a man's ear, and fired off when in that interesting position.

But it is the getting them, on all desirable occasions, into such positions, when wanted, that appears to be the main difficulty. We forget how many tons of lead those old muskets were supposed to have fired off for every man killed, but certainly it was out of all comparison with what was expected of them.

The torpedo boats which accompanied the Evolutionary Squadron to Bantry Bay, and which broke down on the journey, are, possibly, much too small for the torpedo defence of the coasts and harbours of this country. As already pointed out, the weather is too treacherous in these latitudes for such small craft to make any headway, when such becomes desirable. In the event of a fleet attack upon such a place as the Humber, or about Dover, except in the calmest weather, such vessels attempting to concentrate upon the attacking point, from their various stations, would never succeed in arriving in time. They may be suitable enough for harbour defence, when the water is smooth, but should not be depended on for anything further, because, to use an expressive phrase, a head sea "knocks them into a cocked hat, in no time." However small they may be built, they will probably never be small and effective enough to elude the vigilance of a watchful ironclad, except under such favourable conditions as smooth water, without a ripple, and a dark foggy night, when such vessel may be at anchor and in such position as to admit a *stealthy* approach. To a large ship moving through the water at speed, they will probably never succeed in approaching, without being discovered in time to receive anything but pleasant attentions from her machine and other guns. When the sea is not perfectly smooth, even if partly submerged, they could never approach anything without being *heard*, if not seen. The swash of water around the bows of a torpedo boat in such a jubble of a sea as frequently gets up in Plymouth Sound, would be quite loud enough to betray her approach to a vigilant officer, or to half-a-dozen gunners, in time to make short work of her, by a vigorous and well-directed fire. Such, at least, is a fair and reasonable assumption. So much, of course, would depend upon the vigilance of the ship's officers and the other crews patrolling the ship, also in torpedo boats, or steam launches, armed with machine guns. The booms which the Evolutionary Squadron constructed in Bantry Bay for the defence of themselves and for Berehaven, if built in the ordinary way, with a stout wire hawser stretched across the entrance, and this hawser buoyed up by spars and secured by anchors, would be but a poor defence, even against the splendid but unscientific seamen of Benbow. Gunpowder, in the days of Nelson, shivered such booms to atoms; and when chains would not sink, they were lashed across the muzzle of a boat's gun and quickly cut asunder by a shot. Mines can be destroyed by countermining, and when a passage has been cleared of such impediments, the bows of any old ironclad would speedily clear the road of all obstructions against torpedo boats.

According to present arrangements, the Admiralty reckon on building not more than 50 torpedo boats during the next three years. If their programme was to build 300 during the next twelve months, it would surely be a wiser policy, and a cheaper one in the end. There would then, possibly, be no more hurried demands for eleven millions, to defend the country, or to attempt to do so, which sum would be totally inadequate after the defences had been allowed to run down. There are plenty of shipyards in the country ready to build, and also plenty of men too anxious to be at such necessary labour. This, surely, would be a far wiser policy than leaving everything to be done at the last moment.

The crews of these boats would have to be got together, and that could only be done after they were built; and when the men had been found, they would require drilling, which can be done neither in a day nor a month effectively. The boats should be stationed, one or two in any harbour round the coast, according to population, and the crews selected from the engineers of the place and the fishermen together. With such a fleet, manned by volunteers, we could dispense with Channel Squadrons for home defence; for there is no nation, nor any two nations, in Europe, which would dare to send either their ships or their soldiers against the coasts of a country which could, within twenty-four hours, concentrate a fleet of 300 sea-going torpedo boats around any given harbour or headland.

LINKLATER'S PATENT FREEING PORTS.

MESSRS. J. & T. Linklater, of Tynemouth, have recently patented an improved method of fitting freeing ports in the bulwarks of vessels. The special advantage of these ports is that they furnish a speedy and always available means of exit for any water which may break on board of a vessel, whilst at the same time effectually preventing the inflow of water through the same passage. Messrs. Linklater accomplish this by forming ports with a strong frame and of much greater length than the ports usually employed, and fitting therein one or more narrow flaps, which are hinged in the end of the frame. By forming the hinges with considerable crank inboard, these flaps always have a tendency to hang close, no matter to what angle the vessel may roll. When water finds its way on to the deck it runs against the ports as the vessel heels over, and the port flat opening immediately under the pressure of the water which finds egress through the ports; but by an ingenious arrangement of the port flaps they instantly close when relieved of the internal pressure, or when struck upon the outside by a wave, so that no water can be thrown on deck again through the ports. The ports are thus entirely self-acting, presenting in this respect a striking contrast to the ordinary ports, which as at present constructed are often of little value; as when closed they are firmly secured by latches, and cannot open of themselves when required, whilst if kept open they are a source of discomfort and danger, just as readily admitting water from the sea as allowing water to run off the deck. Loose deck gear and even men have not unfrequently been washed overboard through these ports and lost, a contingency that is altogether impossible with the close hanging flaps of Messrs. Linklater. It will thus be evident that the adoption of the improved ports in all vessels having bulwarks, will materially add to the comfort and safety of such ships in heavy seas. In no case probably will the new ports be of more advantage than in well-decked vessels, for which they appear to be specially adapted. In this type of vessel, as is well known, water accumulates in very large quantities in the forward well space, demanding special facilities for rapidly freeing the deck. These usually take the form of four or five ordinary clearing ports along each side of the well space, while in some instances, in order to meet the views of the Board of Trade, large open ports have been cut in other parts of the wells. These large ports, however, have met with very little favour from owners and masters who have been compelled to use them, and, indeed, in the opinion of many they but constitute an additional source of positive danger. Messrs. Linklater propose for well-deck ships to form a large port with three or four flaps at the after end of the well space just forward of the bridge front, where there is most need of an expeditious outlet for a large body of water. The long narrow flaps will thus form a protection on the port opening, and prevent the seamen or gear being washed overboard through the port. Three or four more ports with one or two narrow flaps to each might also be fitted in the bulwark along the forward part of the well. It is hoped that the introduction of the improved ports will in a great measure, if not entirely, remove one of the most serious objections to the useful well-deck type of vessel. Another advantage of the new description of ports which ought to be mentioned is that the hinges are so made that they can readily be shipped or unshipped at any time, thus admitting of the flaps being lifted off and the port openings used in the loading or unloading of cargo. We understand that the invention has been exhibited to the Committee of Lloyd's Register, the Load-Line Committee, and other representative shipping bodies, and has been well received on all hands. Already several vessels, both steam and sailing, now building are being fitted with the arrangement.

THE RECENT EXPLOSION IN THE "INFLEXIBLE."

AFTER the inquiry by the Committee of the Admiralty in 1882 respecting the cause of coal gas explosions on board the ships of the Royal Navy, and how to avoid them, it is astonishing that the recent accident in the *Inflexible* occurred. We are informed that after this famous ironclad had been partially coaled in readiness to sail with Admiral Hornby's squadron, the lids were placed over the shoots on the Friday afternoon, when the Queen's birthday holiday began. On resuming work on the following Monday, one of the men went into the bunker with a naked light, when an immense flash of fire shot up the shaft, though it did not cause a report as of an explosion. One of the occupants of the shoot was dreadfully burned about the legs, and those waiting to descend were thrown down in all directions. So serious were the injuries sustained by seven or eight men that they were sent to Haslar hospital.

A considerable time is likely to elapse before the result of the official inquiry concerning this explosion is completed. In view of this, and the consideration of the report of, and the evidence taken before the Committee of the Admiralty on Explosions of Gas in Coal bunkers in our Men-of-war—which was not published until the completion of our series of articles on the "Ventilation of Ships" in the latter part of 1882 and the beginning of 1883—we propose to offer a few further remarks upon these accidents. To prevent the accumulation of gas and explosions in the bunkers, and the means for ascertaining the presence of this air and exhausting such, the committee are of opinion that the system for the ventilation of the receptacles should be continuous, and entirely separated from that used for other portions of the ships. This latter part of their recommendation is very important, otherwise the marsh gas might come into contact with a naked light, and so cause an explosion. While we agree with this and the second recommendation—that to render such ventilation reliable it is necessary to admit fresh air, as well as provide for the escape of any coal gas, we doubt whether the suggestions for abstracting this foul air will be efficient. The committee state that the escape of this atmosphere "may be secured for a series of bunkers by connecting them with a common trunk passing along the top with an outlet from each into this trunk, which should lead into the funnel air casing, the iron masts, or any vertical shaft. Such a system would be applicable to the bunkers in all the various classes of ships in the Royal Navy, irrespective of their relation to watertight bulkheads and flats, or whether placed above or below armoured decks." No mention is made respecting the number, position, and relative area of inlets for the admission of fresh air, without which an outlet would abstract but a very small part of the gas, and then only in a fitful way.

It occurs to us that the coal bunkers should be separately ventilated, if possible, so that each should have one vertical shaft outlet, inasmuch as if an outlet is at a long distance from the end of a horizontal pipe connected with it, and which pipe has numerous apertures intended for the escape along it of coal gas into the shaft, the exhaust effect of the outlet will only efficiently operate on the few nearest openings of the pipe—as is the case in buildings—no matter how good the inlets may be. Each bunker should also be supplied with inlets for admitting fresh air fixed at about equal distances apart, and the aggregate area of which should be a little in excess of that of the outlet, so as to exert a propelling power upon the gas. It is desirable to surmount the outlets with the most efficient exhaust ventilators or fixed finials. Under no circumstances should a naked light be taken into a bunker. The most approved safety lamps alone should be used for the artificial illumination required therein, of which there are several kinds, including Trouves' portable electric lanterns, which can be used with absolute safety in the presence of the most explosive of gases.

It is also essential that in addition to promoting the best ventilation of coal bunkers for all ships of war—and to ascertain which the most satisfactory tests should be made—stringent regulations should be in force to prevent naked lights being admitted to the bunkers.

It is to be hoped that the committee who investigate the cause of the explosion in the *Inflexible* and the extent of the injury it has occasioned, will recommend the most efficient measures to be taken without delay to ventilate the bunkers and other coal receptacles of our warships, and that steps will be taken and proper regulations adopted to secure this requirement as quickly as possible.

COLOUR BLINDNESS IN THE MERCANTILE MARINE.

THE annual report recently published of the Assistant Secretary of the Marine Department of the Board of Trade, respecting Colour Blindness in the Mercantile Marine, contains some interesting particulars. It appears, however, that better means should be adopted for conducting the examinations on this subject, which certainly seem quite inadequate for the public safety.

The persons examined by the Board of Trade are candidates for masters' and mates' certificates, and others. The last class are apparently a few able bodied sailors who come to be examined for the small sum of one shilling. Their number is not, however, given, but it is probably small; their examination is not compulsory, like that of the superior candidates. During the twelve monhs ending May 31st, 1884, thirteen of the latter failed to pass the examination satisfactorily; but as five passed subsequently, the number of rejections has only been eight. The date of the last examination recorded is the 7th of April, 1884. It is strange that the report does not contain particulars to a much later date. For the five years ending May 31st, 1884, the number of candidates examined were 21,720, and the percentage of the rejections do not probably exceed above 0·56 per cent. All the candidates but one are stated to have named the large red card held at arm's length as green, or *vice versa*. The average time which these men had been at sea service was eight years, while four were, at the time of undergoing the test, serving as officers. A failure to pass the examination does not prevent candidates for masters' and mates' certificates from being engaged for the command of ships. This may result in collisions and other ill consequences at sea. More competent examiners should be appointed than the present ones, who are principally retired master mariners. We agree with the report that the examination should be extended to pilots. It is essential, however, that the Board of Trade should be empowered to apply the test compulsorily to other seamen than this class of candidates for masters' and mates' certificates, when circumstances render this course advisable.

LAUNCH OF H.M.S. "BENBOW."

ON June 15th there was successfully launched H.M.S. *Benbow* from the dockyard of the Thames Ironworks and Shipbuilding Company, Blackwall, affording a numerous concourse of spectators the pleasure of witnessing at once a majestic and a pleasing spectacle. The christening and formal act of releasing the vessel was performed by Mrs. Gladstone. For a long time before the hour fixed for the launch the dockyard of the Thames Shipbuilding Company presented a very animated scene. There was a goodly display of bunting on the vessels in the vicinity, whilst thousands of spectators were present. A grand stand decorated with crimson cloth was erected, and a tastefully-designed axe of polished steel with helve of walnut mounted in silver, and suitably engraved—for presentation to Mrs. Gladstone, as the instrument with which the small blue silken cord was to be cut—was an object of great interest. Mrs. Gladstone, with other distinguished visitors, proceeded by special steamer from the Speaker's Stairs at Westminster, and arrived at Blackwall at about two o'clock. She was accompanied by two of her sons, Mr. W. H. Gladstone, M.P., and Mr. H. N. Gladstone. Amongst those also present were the Earl of Northbrook, Sir Thomas Brassey, M.P., and Lady Brassey, Mr. G. W. E. Russell, M.P., Mr. W. S. Caine, M.P., M. Waddington (the French Ambassador), Admiral Brandreth, Controller of the Navy, Sir Frederick Bramwell, Mr. F. K. Barnes, of the Council of Construction, Hobart Pasha, and many other influential persons in naval circles. As the steamer entered the mouth of Bow Creek the *Benbow* was seen stem on, the Nordenfelt towers and twin screws projecting on each side of the novel form of stern giving an impression of immense power and solidity. The illustrious visitors landed alongside the vessel, and were received by the officials of the company. Walking with the Earl of Northbrook, Mrs. Gladstone proceeded to the grand stand, where on a dais were arranged the block and cord which was to be severed. The Rev. J. Buckley, vicar of St. Luke's, Victoria Docks, then read the authorised brief service for use at the launching of ships of her Majesty's Navy. About an hour's delay took place whilst the task of cutting away some woodwork proceeded,

but the waiting was enlivened by a performance of the Thames Ironworks Military Band. A large garland encircled the torpedo port in the upper part of the stem, taking the place of the usual figure-head, which, like many other fittings of the past, now yields to the necessities of modern warfare. When all was in readiness, at the pilot's signal, Mrs. Gladstone cut the cord, and performed the usual christening ceremony, the falling weights were released, the dogshores fell, and, to the strains of "Rule Britannia," followed by "Hearts of Oak," the *Benbow* glided down into the river amidst vociferous cheering. The present netweight of the vessel is a little under 5,000 tons. The four immence hawsers, used for checking the vessel soon came into play, and the *Benbow* was brought up in front of the Trinity Wharf, where a large company of the Elder Brethren had assembled to witness the launch. Immediately a flag, bearing the words "H.M.S. *Sans Pareil*," was hoisted, intimating that the Thames Shipbuilding Company have another Government contract on hand. The principal visitors, to the number of about 300, then sat down to luncheon in one of the spacious shops, which was tastefully fitted up and decorated for the occasion. In our next number we propose giving full description with illustrations.

LOBNITZ'S PATENT GUIDE WHEEL.

THE improvement of the channel of the River Clyde has occupied the attention of the Clyde Navigation Trustees for a long period of years, and has been carried out with such a measure of success as to convert the Clyde, formerly a shallow stream, into a noble river, navigable by the largest vessels afloat. This enormous undertaking has been accomplished with signal ability and economy, and since the commencement of the work the depth of the channel has always been kept in a condition to meet the requirements of the day, a fact reflecting great credit upon the administration. The work was commenced many years ago, and the dredging machines which were constructed for the purpose were in those days perhaps in advance of their time; and that they were strongly built and have been well kept is proved by the fact that most of them are still in operation. It was not anticipated, however, in those old days that the Clyde would be called upon to afford a passage to vessels of the enormous tonnage common enough now, but which have only of late years come into fashion. It is now found that these vessels, drawing, say, 24 ft. and upwards, have at times considerable difficulty in making their way up to Glasgow, so that it becomes necessary to deepen the channel to some extent to meet the requirements of increasing size in modern steamers. The dredgers now doing the work, have, however, arrived at the limit of their capability as regards the depth at which they can work, and it has become absolutely essential to make such alterations upon them as will obviate this difficulty, if their services are to be retained. The ordinary method of accomplishing the desired object would be to lengthen the bucket ladder and bucket chain, which would render necessary the lengthening of the vessel itself. This, however, is a serious undertaking, entailing great outlay and loss of time—the costliness of the expedient displaying itself not only in the amount to be charged against the actual lengthening of the vessel, the bucket ladder and the bucket chain, but notably in the increased annual charge for repairs and renewals consequent upon the increased number of buckets in constant usage, and the proportionate increase in friction on each component part of the bucket chain, resulting from its increased weight. This annual charge capitalised would of itself form an item by no means to be lightly considered. The lengthening operation would necessarily entail the entire loss of the services of the dredger during the continuance of the work, and might thus diminish her total work by 20 per cent. for the year in which her lengthening is done. The Clyde Trustees, in view of all these considerations, put themselves into communication with Messrs. Lobnitz & Co., engineers and shipbuilders, of Renfrew, who are builders of the latest and most improved types of dredging plant, and who have patented many of the improvements recently introduced by them into the dredgers they have built and are now building for the Panama Canal Co. and other companies. This firm has effected an astonishing improvement upon the capabilities of the No. 8 dredger belonging to the Trustees by the application of "Lobnitz's Patent Guide Wheel," an exceedingly simple but efficient device, by means of which this dredger, formerly brought to a standstill when the rising tide made 23 ft. depth of water, can now do her work with as much ease and efficiency in a depth of 38 ft. Indeed, while the power required is certainly not more than formerly, the efficiency is much increased, as the guide-wheel supports the "bag" of the bucket chain to a great extent, and so relieves the strain on the chain, thus materially reducing the wear and tear on the working parts. Besides, the curve of the "bag" of the bucket chain becomes entirely different, causing the buckets to be better capsized over the upper tumbler, thus emptying them more efficiently, and giving a better cutting angle to the buckets as they approach the lower tumbler. These important improvements and advantages obtained by the introduction of "Lobnitz's Patent Guide Wheel" have been effected in about 14 days, at an expenditure of not more than one tenth of the sum that would have been expended in the lengthening works we have mentioned. No. 8 dredger has been at work at Erskine Ferry since the completion of the alteration, and has been working most efficiently. An official trial was made of the patent guide-wheel on the 6th of April, under the superintendence of James Deas, Esq., the engineer of the Clyde Navigation, and in presence of the New Works Committee of the Clyde Trustees, who expressed themselves thoroughly satisfied with the adaptation. It has been found since the application of the patent guide-wheel to the dredger named, that a marked improvement has been effected in the working of the engine, which previously worked at 31 revolutions per minute. *Now* working in the same ground at a much greater depth, the engine makes 33 to 34 revolutions per minute, showing a great diminution of friction, and consequent reduction of wear and tear.

HER MAJESTY'S SHIP "SURPRISE."

THE steel despatch-vessel *Surprise*, which recently arrived at Portsmouth from Palmer's Shipbuilding Company's yard, where she was constructed, has completed her steam trials in the Solent. Although resembling in some respects the *Salamis* and *Enchantress*, she and her twin ship, the *Alacrity*, in course of completion by the same company at Jarrow, differ from them in so many material points that they may be regarded as a distinctly new type of ship. Although not intended for fighting purposes, their designers yet contemplated the possibility of their being employed as scouts, and as a matter of fact they were intended to have acted as such had war taken place between this country and Russia. The *Surprise* is entirely built of steel, and is luxuriously furnished and embellished for the special purposes which she is intended to subserve as a despatch-vessel. She measures 250 ft. in length, by 30 ft. 6 in., and has a displacement of 1,400 tons. Her load draught is 12 ft. and 14 ft. forward and aft respectively, with a freeboard of 6 ft. 9 in. Of her entire length the machinery compartments take up no less than 114 ft. As the *Surprise* is entirely unarmoured, various novel devices have been resorted to with the object of protecting her as far as possible against the attack of machine and light guns. An arched steel deck three-eighths of an inch thick runs throughout the whole length of the ship, enclosing the engine spaces, and this protection is supplemented at the ends by water-tight platforms, which afford a measure of safety against the consequence of collision and give rigidity to the structure. Along the sides amidships, above and below the protected deck, for a distance of 114 ft., are the coal-bunkers. These are 7 ft. in breadth, and are so arranged as to afford the defence of coal armour to the boiler rooms and other vital parts. Besides these means of safety, the hull is crossed by numerous transverse bulkheads disposed in connexion with the arched deck so as to divide the ship into 40 water-tight compartments. The larger hatches, again, are surrounded by coffer-dams, which, when penetrated by shot, could be easely rendered water-tight by being filled with hammocks and other light packing. But while all reasonable means have been taken advantage of to secure the stability and safety of the *Surprise* without increasing her weight to such an extent as to detract from her great speed, the skill of her builders has been applied in an especial degree to adapt her for the particular service on which, as a despatch-vessel, she will be employed. Having to afford accommodation to ambassadors, admirals, and other temporary guests, embarking on official and ceremonial cruisers, every attention has been devoted to secure comfort and beauty between decks. With the exception of the commanding officer in charge of the ship, the whole of the officers as well as the crew are berthed forward, the after end of the ship being reserved for the accommodation of official personages. The

lower deck aft contains a suit of handsome apartments, the rich ornamentation of which is of unusual merit, being all formed from natural wood, and consequently without the addition of paint. The lobby is finished in polished teak, with carved pilasters and gold mouldings. The dining saloon on the lower deck is a capacious and elaborately ornamented room, measuring 18 ft. by 24 ft. The dado is formed of highly polished mahogany panels, arranged in Queen Anne style, surmounted by panelling in maple and satin wood, the effect being exceedingly rich and effective and at the same time quiet. The drawing-room and reception rooms under the poop are reached by a broad staircase. The former is finished entirely in maple and satin wood, the tone being light and pleasant, while the latter are decorated in white and gold. The whole of the mirrors and furniture are in harmony with the prevailing colour. The apartments are fitted with electric bells and lighted by unusually large circular side lights. Thorough ventilation is secured in ordinary circumstances by a system of natural draught; but in bad weather, when everything requires to be securely battened down, the whole of the living parts of the ship are ventilated by means of forced currents. Comfort between decks is further secured by sheathing the protected deck in wake of the engines with two inches of silicate cotton and an inch and a quarter of teak planking, whereby the heat from the engine-room is prevented from interfering with the comfort of the reserved apartments. Both the taste and workmanship of the interior decorations are creditable to the builders.

The propelling machinery consists of two pairs of horizontal compound engines, having cylinders of 26 in. and 50 in. diameter respectively, with a stroke of 34 in. Steam is supplied at 100 lb. pressure by four boilers, two of which have two furnaces and two have three furnaces each. The stokeholds are arranged to work either with natural or forced draught, the latter being produced by four fans each 4 ft. 6 in. in diameter. At the natural draught trial the collective power developed by the engines amounted to 2,104 horses, which was considerably above the contract. The speed realized was 16·49 knots, while the coal consumption amounted to 2·6 lb. per unit of power developed. At the trial the engines were worked for four hours under forced draught, when equally satisfactory results were obtained. Commander the Hon. F. Sandilands was in command, and the trial was conducted on the part of the contractors by Messrs. Hall and Logan, Mr. Bakewell representing the Admiralty, Mr. Corner the Dockyard, and Chief Engineer Waterfield the Steam Reserve. The draught of the ship was 11 ft. 3 in. and 13 ft. 3 in., or slightly less than her designed load-line. The weather was particularly fine, and the course steered extended in long reaches beyond the Nab and back to Cowes, the measured mile in Stokes Bay being taken in passing to and fro. After the first half-hour the engines gradually worked up so well that the mean results were taken from the beginning of the observations. These gave a mean of 96·6 lb. pressure of steam in the boilers, 133 revolutions per minute, and a collective horse power of 3,017·66. The efficacy of forced draught was thus clearly demonstrated, the more especially when it is stated that calculations made on board gave a fuel consumption of 2·78 per hour. The means of four runs on the mile gave a speed of 17·846 knots, the average of the log during the trial giving a speed of 18·31 knots. On the conclusion of the trial the steering of the ship was tested. The circle was 244 yards in diameter, and it took three minutes to perform it. This was done with manual gear, but the difficulty of getting the helm over in ships of such speed as the *Surprise* demonstrates the necessity of having them fitted with steam steering engines. When commissioned the ship will have a complement of 86 officers and men. Her bunkers will stow 400 tons of coal. The *Surprise* is intended for the Mediterranean.

On May 23rd, there was despatched from the Clyde a twin-screw steam launch, which has been supplied by Messrs. London Brothers, Glasgow, to the Admiralty, for the Royal Naval College, Greenwich, for purposes of instruction in nautical surveying and compass adjusting. The hull, which is of steel, was built by Messrs M'Knight, M'Credie & Co., Ayr, and the engines were supplied by Messrs. Dunsmuir & Jackson, Govan, Glasgow.

Large shipbuilding contracts have been entered into on the Clyde. Messrs John Elder & Co., of Govan, Glasgow, have contracted to build three steamers of 5,500 tons for the North German Lloyd. The steamers will be fitted with all the latest improvements. The news has been received with great satisfaction in Govan, where thousands of men are idle.

EXPERIENCE IN THE USE OF THICK STEEL BOILER PLATES.

By Mr. W. Parker.*

An ordinary cylindrical boiler of 13 ft. diameter and 16 ft. long, designed for a pressure of 150 lb. per square inch, for which the scantlings were amply sufficient, burst under the hydraulic test. The pressure was applied very carefully, and when it had reached 240 lb. the fracture occurred, extending completely across one of the shell plates, and to a slight extent also into the adjoining plate, as shown on the diagram. The boiler was constructed entirely of steel, made on the Siemens-Martin process by a firm who enjoy the reputation of producing a material second to none in the country. The plates were all tested at the steel works, and fulfilled the requirements of both Lloyd's Register and the Board of Trade. I find from our surveyor's report that the sample from the particular plate which failed, which was 1¼ in. thick, stood a tensile strain of 29·6 tons per square inch, with an elongation of 20 per cent. in a length of 8 in., whilst strips cut from it were bent almost double cold. In fact, the material appeared, from the mechanical tests applied before it left the steel works, to be in every respect suitable for the purpose for which it was intended. One remark, however, may here be made, namely, that the plate in question was exceptionally large and heavy, viz., 20 ft. long, 5 ft. 6 in. wide, and 1¼ in. thick, weighing about 2 tons 16 cwt. This material was built up into a boiler by a company who have had an unusually extensive experience in the manipulation of steel, having turned out no fewer than 175 boilers of this material. The plates were treated precisely as other steel plates have been treated in the same works, and with all the appliances which experience has shown to be necessary; all the holes were drilled, and the plate was then heated in a furnace and bent to the required curvature in a pair of powerful vertical rolls in the usual manner. Under these circumstances it appeared at first sight astounding to find the material tearing under a pressure which represents a strain of 6·7 tons per square inch only, or less than one-fourth of the strain which the original sample withstood. In addition to this the appearance of the fracture indicates that the plate did not possess any ductility, stretch, or elongation whatever. Neither the steel makers nor the boiler-maker have as yet afforded any satisfactory explanation of the occurrence. It is without doubt a most serious affair, especially in view of the high pressures which have now become so common. On hearing of this accident the committee of Lloyd's Register instructed me to investigate the matter, endeavour to ascertain the cause of the accident, and, if possible, recommend some measure to prevent such an occurrence in the future. My investigations were only completed last Tuesday, and as such a serious matter as this, which bears upon the safety of life and property at sea, must naturally give rise to no little speculation amongst engineers and steel makers, and has already produced great consternation in many quarters, I have taken this opportunity of laying before you a short statement of the facts as they have come before me, the results of my investigations, and the conclusion which I have arrived at, with a view to eliciting from the various steel makers and steel users here the benefit of their views and experience. Upon my visit to the boiler-making works, I was fortunate enough to find a sister boiler to the one which had burst, ready for testing. This boiler was tested in my presence to 300 lb. per square inch, and was carefully measured and gauged, and found to show no signs of deflection or yielding. I also ascertained, from an examination of the testing appliances, that an abnormal pressure could not possibly have been exerted at the time of the testing of the first boiler. Seeing that the plates that broke had stood all the mechanical tests required before leaving the steel works, and that when worked into the form of a boiler shell it gave way at less than one-fourth of its original strength, it appeared, at first sight, that the plates had been in some way injured, or had undergone some material change from the time they left the steel works until they were rivetted into the form of a boiler shell; therefore, it became necessary to look carefully into the mode of manipulation of the plates in the boiler-shop, and especially the heating and bending of them. One of the plates was bent in my presence. It was heated in an ordinary plate furnace, but when taken out was far from being of an uniform heat; the end of the plate near the door of the furnace was at a black heat, which gradually increased towards the other end to a dark red heat. Then the plate was turned end for end

* *Read at the Twenty-sixth Session of the Institution of Naval Architects.*

and again placed in the furnace with a view to heating it, as far as possible, uniformly, but when again drawn out of the furnace, it was seen that the heat was not at all uniform, one end being of a dark red or nearly black heat, which gradually cooled down to a blue heat at the other end. In this condition it was passed through a set of powerful vertical rolls, and bent to the required curvature. The plate passed through these rolls six times, and by the time the operation was completed, one end of the plate was quite cold, while the other end remained at a blue heat. It was thought that this unequal heating of the plate may have set up, in the body of the plate, excessive strains of a dangerous character, and that these strains were aggravated by rolling the plate at a dangerous heat, it being well known that the ductility of all steel becomes lessened when worked at a blue heat, and it is, I think, generally admitted that it is far safer to work steel cold, or red-hot, than at any heat between these two points. Steel plates, and especially large ones, must be injured by such treatment, but as to the intensity of the strains set up, or their exact locality, nothing definite can be said. To ascertain the nature of the material as it stood, test pieces were cut from the fractured plate, both close to the fracture and apart from it, and subjected to tensile test at one of Lloyd's proving houses, with the following results, which the engineers have kindly communicated to me:—

Samples.	Breadth.	Thickness.	Area.	Total Tons.	Square inch. Tons.	Extension in 8 in. per cent.	Extension in inches.	Contracted area.
	in.							
S. I. X. ..	1	$1\frac{13}{50}$	1·26	40·5	32·14	27·34	$2\frac{5}{16}$	$\frac{11}{16} \times \frac{7}{8}$ & $\frac{1}{32}$
S. C. H. I.	1	$1\frac{13}{50}$	1·26	41·75	33·1	26·59	$2\frac{1}{8}$	$\frac{29}{32} \times \frac{35}{32}$
S. 2	1	$1\frac{13}{50}$	1·26	41·5	32·93	21·27	$1\frac{11}{16}$	$1\frac{1}{32} \times \frac{13}{16}$
S. C. H. 2 X	1	$1\frac{13}{50}$	1·26	39.5	31·35	23·4	$1\frac{7}{8}$	$1 \times \frac{3}{4}$
S. XX. ..	1	$1\frac{13}{50}$	1·26	37·5	29·7	21·8	$1\frac{3}{4}$	$\frac{13}{16} \times 1$
S. IXX ..	1	$1\frac{13}{50}$	1·26	37·25	29·56	26 6	$2\frac{1}{8}$	$\frac{31}{32} \times \frac{35}{32}$
S. XXX ..	1	$1\frac{13}{50}$	1·26	38·5	30·5	28·1	$2\frac{1}{4}$	$\frac{11}{16}$ & $\frac{1}{32} \times \frac{15}{16}$
S. I. XXX	1	$1\frac{13}{50}$	1·26	38·25	30·3	27·34	$2\frac{5}{16}$	$\frac{29}{32} \times \frac{3}{4}$

From these tests it appears that the proved tenacity of the plate ranges from 29·5 tons to 33·1 tons, while the elongation ranges from 21·8 per cent. to 28·1 per cent. in a length of 8 in. I may say that I corroborated these tests by others made from the same plate for my own information in London—the positions of these test pieces are shown on the diagram—and they were also corroborated by other tests made for the information of the steel makers. This range of about 4 tons in the tensile strength of a plate of homogeneous metal like mild steel is very unsatisfactory. I obtained samples of the plate, and submitted them to five eminent and independent metallurgists, who have kindly furnished me with the results of their chemical analyses, which are as follows:—

Carbon.	Silicon.	Sulphur.	Phosp.	Manganese.
·36	·015	·055	·087	1·05
·27	·016	·044	·076	.641
·33	·010	·038	·065	·612
·30	·018	·044	·063	·648
·26	·005	·038	·067	·650

The most striking feature in these analyses is the large proportion of carbon shown to exist in the plate. It is particularly high for boiler plates. Material used for thin plates, say, from $1\frac{1}{4}$ in. to $\frac{3}{8}$ in thick, to stand the same mechanical tests as these thick plates did, would not contain more than from ·15 to ·18 of carbon; and these facts led us to further experiments. In view of the great difference in the amount of carbon required in steel for a thick plate and a thin one to stand the same mechanical tests, it was deemed desirable to make an experiment which would determine to what extent work, in the shape of rolling, and especially rolling thin plates, which, during the latter part of the operation must of necessity be rolled, comparatively speaking, cold, affected the tenacity and ductility of the material. A slab of steel containing about the same amount of carbon as the plate that ruptured, viz., ·33 was obtained at the steel works where the plate was made, and rolled at one heat down to $\frac{1}{4}$ in. in thickness. This material, had it been rolled down to $1\frac{1}{4}$ in. plate, judging from the carbon it contained, and the tests of the broken plate, as well as the opinion of the steel makers, would have had a tenacity of from 30 to 34 tons per square inch. It was found, however, that when rolled down to $\frac{1}{4}$ in. thick its tenacity was increased to from 35 to 41 tons per square inch, with an elongation of from 21 to 24 per cent. in a length of 8 in. Other pieces were made hot and quenched in water. These, when tested, broke at a tenacity of from 44 to 45 tons, and had, practically speaking, no stretch at all. Pieces were cut from the fractured edge of the plate, as shown on the diagram, and subjected to tensile, bending, and temper tests. They showed a tenacity of 33·5 to 34·2 tons per square inch, but they stretched only 13 and 16 per cent., and broke with a crystalline fracture, as will be seen by the specimens produced. They bent cold to a considerable degree, but when made red-hot and quenched with water, instead of bending, as pieces of a thin plate of similar tenacity and ductility would do, they broke under the first blow of a hammer without any bending whatever. The material was so high in carbon as to take a temper and become quite hard and brittle. Further cold bending tests were made from pieces of the broken plate, both before and after being annealed; those which were tested before annealing bent fairly well, strips $\frac{1}{2}$ in. square bent to an angle of 49 to 61 deg., the fracture showing a considerable amount of alteration in form; while those pieces which were tested after annealing bent much better, in fact, almost double. Strips, however, that were heated and quenched in water broke short without any bend whatever at the first blow of a hammer, and thus corroborated the previous experiments made in London. These experiments point to the fact that the plate which gave way must have become partially tempered by the heating and cooling to which it was subjected for the purpose of rolling it into its cylindrical form. The heating not having been uniform, the tempering could not have been uniform, and the variations in the temper no doubt have caused the variations in the strength and ductility shown by the different parts of the plate. The hardest part of the plate yielding less than the rest became naturally more strained, and hence the plate tore at its hardest part at a pressure only a small fraction of that which it would have borne if its yielding had been uniform.

Having thus placed before you the nature of this accident, and the steps taken with the view of unravelling the supposed mystery, I now venture to state what inferences may, in my opinion, be drawn from the results of the investigation. I think it will be acknowledged that a material which is so high in carbon as to take a temper and break short as described, even if it possesses high qualities of tenacity and ductility before being tempered, must be looked upon as unreliable and altogether unsuitable for use in marine boilers. It would appear that the desire to obtain high steam pressures, and to use steel of a higher tenacity consistent with a large amount of ductility, has caused the marine engineering world to unknowingly drift into using a material of an unreliable and unsuitable character for the shells of marine boilers, more especially when the usage which such plates receive in heating and bending is considered, for except among steel makers it does not appear to have been generally known that the thicker a plate is the more brittle and erratic in its behaviour it must become, as compared with a thin plate made to stand the same mechanical tests as far as tenacity and ductility are concerned, as, otherwise, I feel convinced that the increase in tenacity from 29 to 32 tons for thick boiler shells would not have been advocated. So far as I am concerned, and the Society which I represent, I may say that it has always been our endeavour to discourage the use of steel of high strength. The rules of Lloyd's Register require boiler plates to have a tensile strength of from 26 to 30 tons, and have done this from the commencement of the use of steel, because we felt that the higher the tenacity arrived at the more likelihood there would be of the plates giving trouble, and our whole desire has been to keep the material mild. We have, however, had considerable pressure brought upon us by manufacturers and engineers to allow a strength of 32 tons per square inch for thick boiler shell plates. This accident and the investigations which have followed clearly point out that engineers have been drifting towards the use of an unreliable material, or at all events a material which is too near the verge of danger to be pleasant, a state of things that should not exist with steam boilers. I would therefore urge, in order to remedy this growing evil, that the tenacity of steel plates for boiler shells – which are becoming thicker every day—should in no case exceed 30 tons; and that a temper test should be insisted on from every thick plate, and the practice of using enormously large plates should be discouraged; while more care should be exercised in uniformly heating and bending these plates. I have conferred with the principal steel makers in the kingdom on this subject, and

am able to say that they agree with me, and are decidedly of opinion that steel plates over an inch in thickness, and having a tenacity of more than 30 tons, must contain so much carbon as to render them unsuitable for boiler-making purposes, although they may possess the necessary tenacity and ductility to withstand the usual tensile and cold-bending tests. I venture to hope that this paper will be made the subject of a discussion, with a view to obtaining further opinions respecting the important points in question.

International Inventions Exhibition.

(*Continued from page* 72.)

DELTA METAL.

Mr. Alexander Dick, of 110, Cannon-street, London, E.C., appears at this exhibition with a collection of exhibits of his Delta metal, which is highly interesting to everybody connected with the metal trade, as fully illustrating the rare qualities of this alloy, and the rapid advances it has made in all the various branches of engineering.

Very prominent is the collection of delta forgings and stampings. When at a dark red heat this alloy can be forged and stamped more readily than wrought iron, and thus treated becomes as strong as steel. Besides the considerable increase in strength, another desideratum of great importance is gained by this way of working the metal, viz., blowholes (which frequently occur in castings, and can often be detected only after expending much time and labour) are quite impossible in stampings. These articles are forged and stamped out of the solid rods, sheets, or ingots. A great variety of parts of engines, electrical machines, valves, handles, &c., are among the stamped articles shown, whilst amongst the forgings may be seen bolts and nuts, studs, valve spindles, pump rods, shafts, &c., which possess over thirty-four tons tensile strength, and a correspondingly high resistance to torsion.

Among the castings, propellers, bearings, boiler and ships' deck and engine fittings, &c., will insure the attention of all practical engineers, whilst the collection of ornamental work will interest the public in general.

Amongst other applications we may mention a patent chain for water wheels cast entirely in Delta metal, and exhibited by the inventor of the chain, Mr. Sealey Allen. This chain, the links of which were cast in Delta, is as strong as if made of wrought iron, whilst its wearing capacity is of course very much higher, and, practically speaking, it will never rust.

Specimens of Beldam's corrugated valves, spun up from Delta sheet, will attract the attention of all marine engineers; some of them have been in use in steamers running more than 50,000 miles, and only show slight traces of wear.

We also call attention to a forged propeller shaft with propeller, and a forged connecting rod with rough part of ingot still left at one end, as specimens of beautiful work executed by Messrs. Alexander Wilson & Co., as well as torpedo shafts. A great variety of hexagon, round, and flat bars, hard and soft corrugated and perforated sheets, &c., are interesting to engineers.

MESSRS. ENGELBERT'S LUBRICANT.

Amongst the minor, but not less important, exhibits at the Inventions, is the well-known lubricant of this enterprising firm, working through a new sight-feed oil cup; which, along with the lubricant itself, has received so many highly deserved encomiums from all classes of engineers.

The condensed steam from the boiler carries this invaluable oil through the glass tube of the "oil cup," where it may be distinctly observed in its passage to the cylinders, or to other places demanding its presence. The "cup" on exhibition, is a handsome instrument of white metal, and constructed in such a way as to give much satisfaction to the careful engineer. It is a fac-

simile of those which are supplied, with this difference, that the latter are made of gun metal, also highly finished. We understand that the Messrs. Engelbert make a speciality of the manufacture of this oil, which is said to leave no dirt, nor deposit of any kind in the cylinders; and in its application to machinery, as a general lubricant, to leave no gumming or clogging refuse.

But perhaps the most prominent and invaluable quality attached to it, the feature *par excellence*, which has already established its value, is its anti-corrosive properties, and absolute freedom from any kinds of acid. As an illustration of this valuable property in its composition, its inventors and manufacturers have boldly placed it, side by side, with six different kinds of oils, commonly used as lubricants. In the neatly arranged case, which con-

tains two large glass vases of Engelbert's dark-coloured lubricants, are eight circular, shallow brass cups, all standing in a row, and exhibiting, some of them, in a very marked degree, the development of corrosive action. Of these eight cups, the two containing the dark oil under notice, are perfectly free from any discolourment, although they have been standing under trial since the opening of the exhibition—considerably over two months—and to this fact we would call the attention of all who visit the exhibition, or who are interested in machinery, and know anything about the damaging results from corrosion and pitting, in valves and boilers, caused, in so many cases, by objectionable lubricants. In addition to the two Engelbert cups, there is one containing olive oil, one castor, another lard, another rape, neatsfoot, and tallow. Most of these have turned very green about the upper surfaces of the cups, from which the contents have been slowly evaporating during the last two months, and possibly the neatsfoot, and the lard, are the two least favourable in appearance.

The cups containing Engelbert's manufacture would certainly, by their appearance, go far to support their claim as the manufacturers of a lubricant which "entirely prevents corrosion, cannot decompose under high pressure, removes 'scale' from boilers, and leaves no deposit in cylinders." Independent of the above meritorious character, this dark coloured compound is guaranteed by the makers to be entirely free of all acids, has no alliance with any kind of spirit, is perfectly inodorous, and will not burn under the most unfavourable conditions.

With such a record in its favour, and with a saving economy of fifty per cent. by its use against olive oil, we cannot wonder that this firm have received large orders from the Commissioners of the present Exhibition, or that it succeeded in establishing an envious reputation amongst the engineers at the Fisheries and Healtheries.

In conclusion, we would take the liberty to recommend the manufacturers to endeavour to have their case, No. 261, group 14, removed to a more conspicuous position in the Exhibition, and in a better light than that which it at present enjoys.

THE MAXIM MACHINE GUN.

(*For illustrations, see pages* 96, 97.)

AMONG the many murderous implements exhibited in the firearm section of the International Inventions Exhibition, none is more striking in its capabilities for wholesale and continuous slaughter than the Maxim gun. The French Mitrailleuse and the English Gatling have already acquired a reputation for their murderous qualities in the late Franco-German, Egyptian, and Canadian wars, but their capabilities for wholesale slaughter sink into insignificance before that of this new gun of Maxim. He has been the first to embody the idea practically of the utilization of the recoil of a gun to effect its own reloading and further discharge. This confers such an extraordinary automatic rapidity to the Maxim gun, that with only a single barrel it can deliver as much as 600 rounds a minute, the whole reloading and discharge being maintained automatically so long as the supply of cartridges lasts, without the attention of any gunner. This startling result brings us almost to within practicable reach of a future warfare which shall consist of a deadly conflict between automatic machinery almost unaccompanied by human handling.

The sectional view (Fig. 3) shows in detail the mechanism by which the recoil is made to produce the successive automatic actions of the gun.

A is a block, or bolt, which is caused to slide freely in suitable guides by the recoil of the explosion. B is the barrel. C is the locking device for securing the block to the barrel at the instant of discharge. D is the cocking lever. E the carrier which draws the cartridges out of the belt, and deposits them in the feed wheel G. F is the belt wheel which draws the belt and cartridges into the gun. H is a connecting rod, made slightly elastic by a strong spiral spring. I is the stud against which the cocking lever, D, strikes, upon the rearward movement of the block. K is the shaft connected with the trigger, and also with the controlling chamber L. M is the extractor which starts the cartridge from the barrel. N is the bar which holds the locking device, C, in position, and it raises it and unlocks it at each rearward movement of the barrel. O is a casing surrounding the barrel, which may be used, if desired, as a water jacket. Cartridges are supplied to this gun fitted into a canvas belt. This belt is provided with thimbles, into which the cartridges can be easily filled, and from which they can be readily withdrawn by the automatic mechanism. When one belt has been exhausted by the gun, further belts can be continuously attached. These belts are such as can be conveniently carried in large quantities about the person. The gun works as follows :—

Upon the explosion of the cartridge, the barrel block and locking device recoil quickly through about $\frac{1}{16}$ in., when the block is unlocked from the barrel. The block then travels back alone, drawing with it the empty cartridge case and leaving it in the wheel G. At the same instant the carrier E draws a loaded cartridge out of the belt and deposits it at G. The backward motion of the gun cocks the hammer, and turns the feed wheel G sufficiently far to bring a loaded cartridge in the front of the barrel. The momentum given to the parts carries the crank from the position shown in the engraving to the position shown in the dotted lines, when another discharge takes place, the crank on its return stroke having forced a fresh cartridge before the sliding block out of the feed wheel G into the breech of the barrel. It will thus be seen that the recoil of the gun and the consequent momentum of the revolving crank serves to complete the double action of the discharge of the exploded cartridge shell, the feed to the barrel of a new cartridge with the replacement of the breech block, and the consequent firing of the same.

It will thus be seen that discharge takes place in the two extreme positions of the connecting rod H alternately, and each explosion is thus effected in the time of the partial revolution of the crank handle. It is evidently an important part of this device that the extreme rapidity with which these automatic movements may be repeated, shall be under easy control. This is effected by the controlling chamber L, which is a small liquid brake, the recoil forcing the liquid, such as oil, from one side of the piston to the other, the size of the passage being controlled by the lever K, connected to an outside indicating handle seen plainly in figure I. The external hand crank is necessary to commence the firing of the gun, in order to get the automatic action resulting from

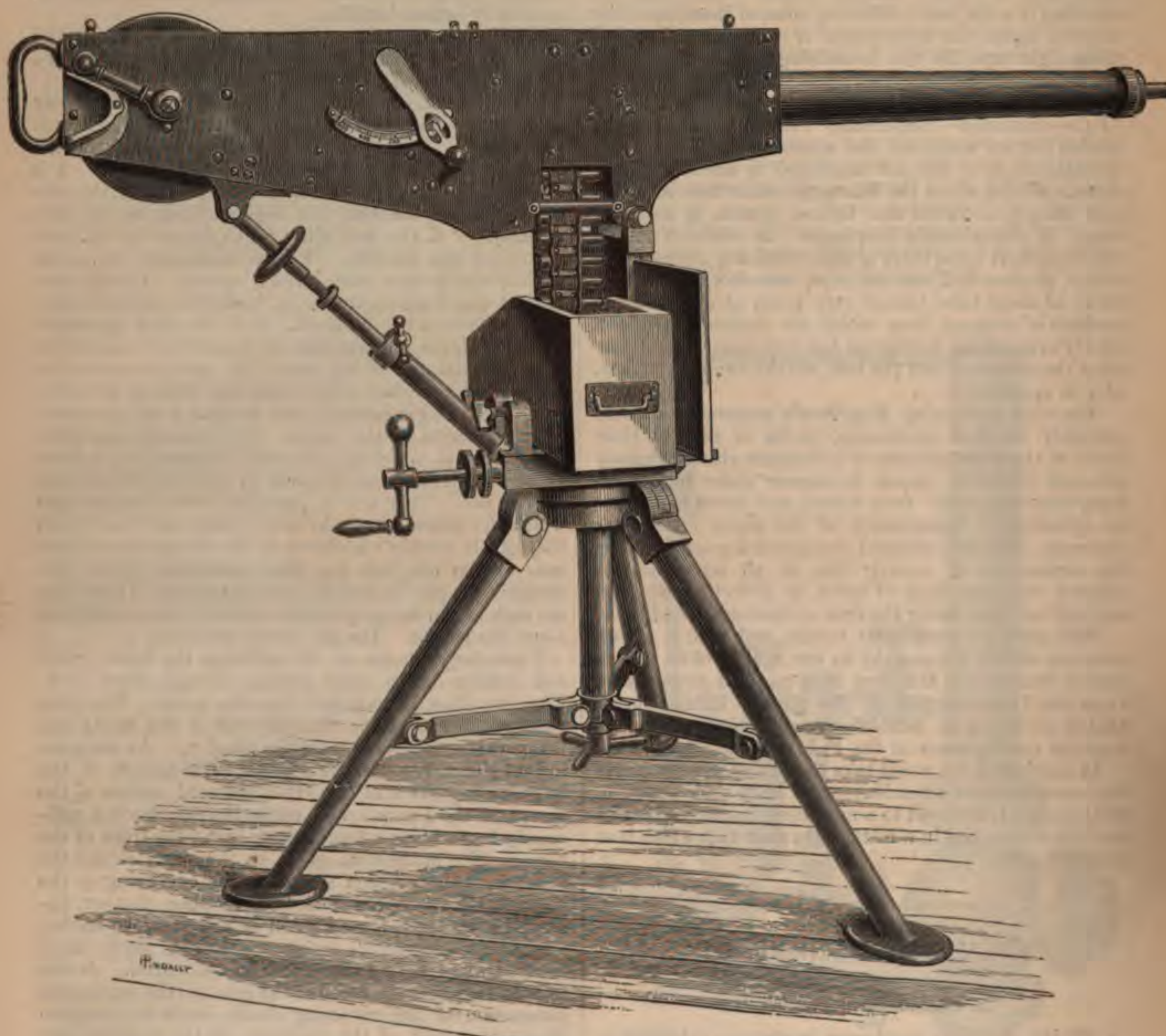


FIG. 1.

the recoil, but it need not afterwards be used, unless a cartridge should miss fire, the same being instantly extracted by a movement of the crank to its other extreme position.

The Maxim gun has a very valuable advantage over any of the other repeating machine guns—which do not depend upon the recoil for their action—in the following respect. Cartridges vary considerably in their time of explosion, and if an extremely quick action is maintained in the ordinary machine gun, there is a risk that the cartridge may be withdrawn from the barrel before it has completely exploded, with danger to the operator. In the case of the Maxim gun the time of fire depends upon, and waits for, the complete ignition and recoil of each cartridge, and therefore maintains the greatest rapidity with quick firing cartridges, and waits any length of time for a slow firing cartridge. If a missfire occurs, the gun stops its action, and the cartridge must be withdrawn by the use of the hand lever. Hence very great rapidity of firing is not only feasible with this gun, but perfectly safe to the operator, the speed being regulated by the external scaled lever from 10 up to 600 shots per minute.

We have no doubt that the many advantages of this gun will lead to its extensive adoption in our own, and other armies and navies, where a more complete and just appreciation of its merits can be formed from actual practice in warfare, than from experimental tests.

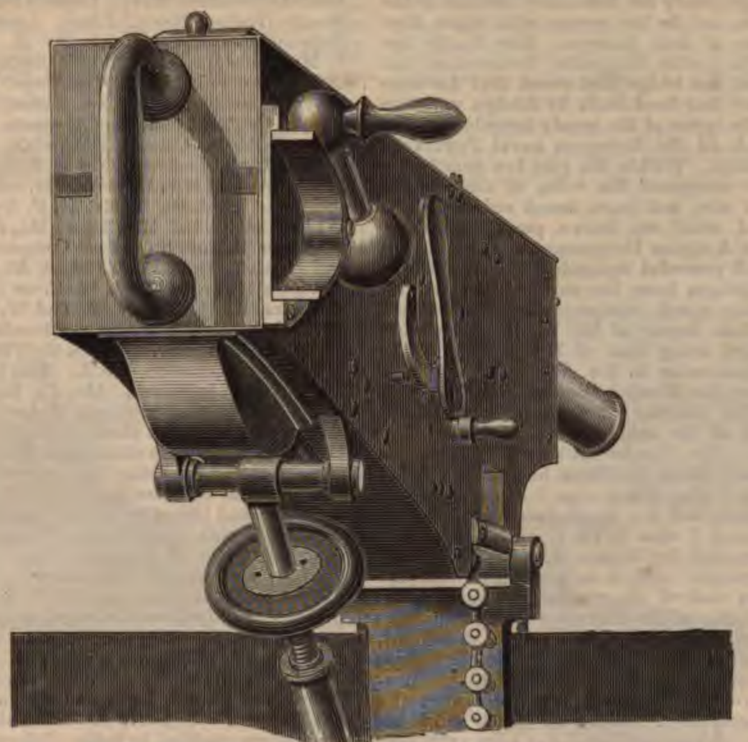


Fig. 2.

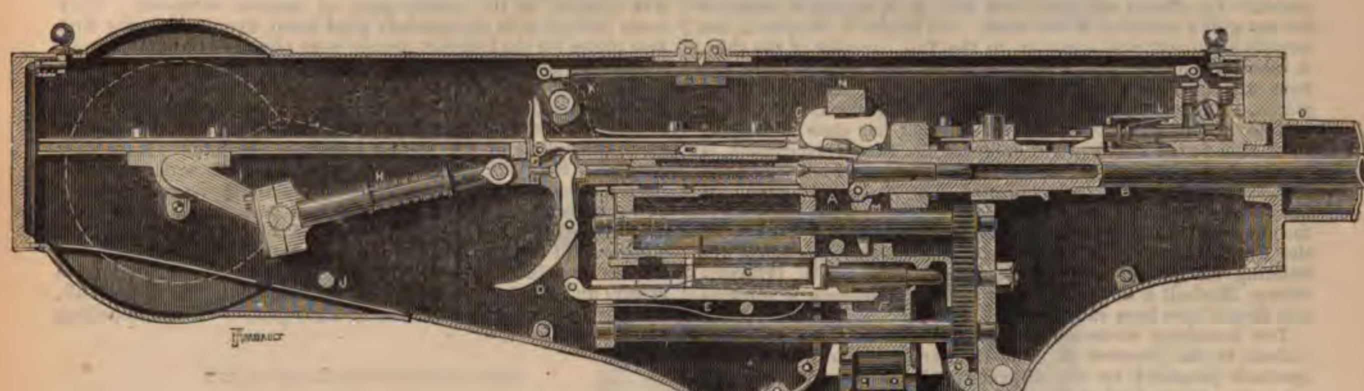


Fig. 3.

LAUNCH OF A TORPEDO CRUISER "THE PANTHER."

THE IRONCLAD "RENOWN."

On June 13th the launch of the first vessel built at the mammoth shipbuilding yard at Elswick took place. It is now only a few years since the project of constructing a shipyard at Low Elswick by Sir W. G. Armstrong, Mitchell & Co., was made public. The announcement of the amalgamation of that firm with the shipbuilding firm of Charles Mitchell & Co., of Low Walker, was the first intimation that the Elswick firm were not content with arming vessels, and were determined to build them. Since the joining of the two companies several vessels of war have been built for the Governments of the Australian colonies, Chili, and Italy. In the meantime, the erection of workshops, and the preparation of the site for stocks at Low Elswick was pushed rapidly forward. Those who remember the Water-street banks of about five years ago, will be astonished at the transformation that has been wrought. The hillside has been fairly delved out, and now bears furnaces and chimneys, while the banks of the river where youngsters were wont to disport themselves by bathing from the "buntings," or anchored timber, now bear war vessels in various stages of construction. Two huge stone or slag dykes with railways upon them run the whole length of the yard, the trains carrying from the works above the metal and other materials required for the use of the shipwrights. Visitors to the new shipyard on June 13th could not fail to be deeply impressed with the vastness of the place, and yet this is but a moderate portion of the works which, by the genius of Sir William Armstrong, have been developed from a very modest undertaking. In October last, when the shipyard was by no means near completion, the firm laid the keel of the *Panther*. That in something less than

nine months she has been got ready for launching, testifies to the great resources of the firm, and to the energy with which they carry on the many branches of their business. The *Panther* has been built to the order of the Austro-Hungarian Government, and it is a remarkable fact that she is the first vessel that for more than a quarter of a century has been built by foreign workmen for the Austrian navy. She is one of the speedy torpedo cruisers, to the construction of which all the European naval Powers are now giving so much attention. Within the past few months the English Government have recognised the value of these handy and destructive vessels of war, and have issued orders for the construction of several of what are known popularly as the "scout" class. When the Austrian Government decided to have built for them two fast and powerful sea-going torpedo cruisers, they invited tenders and designs from the most eminent English shipbuilders, simply stating speed, equipment, and armament. The competition resulted in favour of Sir W. G. Armstrong, Mitchell & Co., the design being that of Mr. W. H. White, formerly Chief Naval Constructor to the Admiralty, and now occupying a similar post at the Elswick Works. Mr. White, it may be mentioned, was the designer of the famous vessel the *Esmeralda*, and, indeed, of all the warships erected by his firm during the past two years. The *Panther* has been built under the direction of Mr. White, and Baron de Haan has superintended the work on behalf of the Austro-Hungarian Government. She is of 1,500 tons displacement, and her dimensions are somewhat similar to those of the "scout" class in the English navy. Her engines, which will be supplied by Messrs. R. & W. Hawthorn, of Newcastle, are very powerful; and it is anticipated that her speed will be greater than that of the "scouts." For obvious reasons, any further particulars of the dimensions and peculiarities of the vessel have not been made public. It may be mentioned, however, that the hull is of steel, and is subdivided into a great number of water-tight compartments. She is fitted with independent engines driving twin-screws, and there are separate boiler rooms. A steel deck protects the propelling machinery and forms the base of the upper coal bunkers, while cellular sides extending throughout the engine and boiler space also serve as coal bunkers and protectors. On the upper deck, a poop and high forecastle have been constructed; and while they will afford comfortable quarters for officers and men, they will, it is expected, enhance the sea-going qualities of the vessel. As might be supposed, the torpedo armament will come up to the full capacity of the ship. A tube for ejecting torpedoes right ahead has been fixed in the bow, and in other parts of the vessel ejecting stations will be placed. In a word, in proportion to her dimensions, the *Panther* will be one of the most powerful ships of her class afloat. A sister ship to the *Panther*, and built for the same Government, is on the stocks immediately to the right of those from which the launch took place, and it is expected that she will be ready for the water in a short time. At the eastern end of the shipyard is the site selected for the construction of the ironclad *Renown* for the English navy. No better indication of the reputation for building war vessels already earned by Messrs. Sir W. G. Armstrong, Mitchell & Co. could be desired than that such a work as this should have been entrusted to them.

The launching ceremony took place between three and four o'clock, in the presence of some thousands of spectators. The spectacle presented by the shipyard and the riverside was one suggestive of the days of the old boat-racing enthusiasm. Looking away across the broad stretch of river to the southern bank, the visitor to the shipyard saw a great crowd waiting to see the *Panther* depart on her career. The shipyard itself was thronged with the workmen, their wives and children, and many hundreds of the inhabitants of Elswick. Every coign of advantage, to use a threadbare phrase, was occupied, even the scaffolding of the stocks and the partially-constructed ships being occupied by sightseers. It was, indeed, a great day for Elswick, and the inhabitants had duly recognised the fact. The scene around the bows of the *Panther* was equally interesting. Amongst the distinguished company invited to witness the launch, and gathered on the crimson-draped platform, were representatives of the navies of Austria, Italy, Japan, Chili, Brazil, Spain, Russia, Germany, and Sweden. Amongst those present were:—Sir W. G. and Lady Armstrong, the Bishop of Newcastle and Mrs. Wilberforce, Baron de Haan (Naval and Military Attaché Imperial Royal Austro-Hungarian Embassy), Baron Barnekow (Swedish Navy), Hon. Leveson Gower, M.P., Mr. J. C. Stevenson, M.P. (chairman River Tyne Commission) and Mrs. Stevenson, the Mayor (Alderman Stevenson) and Mayoress of Newcastle, the Sheriff of Newcastle (Mr. T. Gray), and Mrs. Gray, Mr. and Mrs. Hill Motum, Mr. S. Popper (Austrian Navy), Mr. J. Ulm (Austrian Navy), Admiral Azavedo (Brazilian Navy), Captain Soliani (Italian Navy), Captain Meana (Italian Navy), Lieut. Ijuin (Japanese Navy), Lieut. Hayazaki (Japanese Navy), Mr. S. Hazi (Japanese Navy), Mr. Z. Miyabara (Japanese Navy), Captain Montt and officers of the Chilian iron-clad *Blanco-Encalada*, Commodore José Yllescas (Royal Spanish Naval Commission), Captain Linden (Russian Navy), Captain Oldekop (German Navy), General Steward, General Bogle, Colonel Martindale, Captain and Mrs. Penton, Captain Younghusband, Major Bridgford, Captain Noble, C.B., Mr., Mrs., and Miss Cruddas, Mr. and Mrs. P. G. B. Westmacott, and Miss Westmacott, Mr. H. F. Swan, Mr. and Mrs. W. H. White, Colonel and Mrs. Dyer, Mr. J. R. Ravenhill (Chairman of the River Thames Steamboat Company), Mr. G. B. Hunter (Swan and Hunter), Hon. H. J. Cairns, Mr. and Mrs. James Huddart, of Victoria, Mr. and Mrs. W. Cross (R. and W. Hawthorn), Mr. and Mrs. J. H. Ridley (R. and W. Hawthorn), Mr. and Mrs. W. Dobson, Canon and Mrs. Bromley, Mr. and Mrs. Trewent, Mr. John Hall, Rev. and Mrs. C. Wilson, Mr. and Mrs. R. Brown, Miss Bessie Adamson, Mr. L. Mills (surveyor, Board of Trade), Mr. Boolds (surveyor, Lloyd's Register), Captain and Mrs. Nicholls, Captain Bruce, and Major Cracknell.

At about half-past three, a large body of workmen began to knock out the chocks which held the vessel, and in a short while all was ready for using the lever which would release her. A few moments were occupied while Mr. W. Parry, of South Shields, photographed the party on the platform and also the vessel, and then the launch was effected. Breaking a bottle of champagne over the bows of the ship, Lady Armstrong named her the *Panther*, and wished her success. The next moment the last impediment was removed, and the first war vessel built at Elswick glided smoothly down the ways, dipped into the water, and swam gracefully into midstream. As she moved, the spectators broke into cheers, which were repeated again and again until the *Panther* lay motionless on the river. Elegant in shape, and buoyant as a skiff, the vessel was a sight calculated to delight the heart of a shipwright. Even those who could not consider themselves qualified to judge of the merits of a ship were strongly impressed by the appearance of the *Panther* as she lay athwart of the stream.

The launch over, the attention of the visitors to the shipyard was directed to the performance of another ceremony. They made their way to the specially piled berth upon which the first keel plates for the ironclad *Renown* were placed—one of the largest ironclads yet built—which were lying on the blocks upon the special piled berth which has been prepared at great expense for the safe construction and launching of these enormously heavy vessels. There are to be two such berths in the Elswick shipyard, the piling of the second being now in hand. Here they witnessed Sir William Armstrong "hold on" while the first rivet was being driven into what will be one of the largest ironclads ever constructed. When the rivet had been fixed, cheers were given both for the *Renown* and for the venerable riveter. At the other end of the yard, at the finishing jetty, was to be seen the Chilian ironclad *Blanco-Encalada*, which is undergoing extensive repairs and alterations, including the complete refit of the hull, an entirely new armament, and re-arrangement of the propelling apparatus.

THE NORDENFELT MACHINE GUN AND FIELD PIECE.

AMONGST many exhibits in the firearms group of the International Inventions Exhibition, the now well-known Nordenfelt machine gun occupies a suitably conspicuous position. The small arm machine gun, invented and perfected by Nordenfelt, is now so well known in the British Navy that, although we have pleasure in giving several illustrations of the two-barrelled and five-barrelled hand gun for ship use, and the nine-barrelled gun, mounted as Horse Artillery, we need not detain our readers by any detailed description of this now well-known mechanism.

We need only point out, in comparing this machine gun with others in the market, having only a single barrel, that the multiplicity of barrels serves to enable a

much more continuous fire to be maintained without the overheating of the barrels; and also offers facilities for either volley or file firing, the effects being distributed over a considerable surface represented by the dimension over the ends of the barrels.

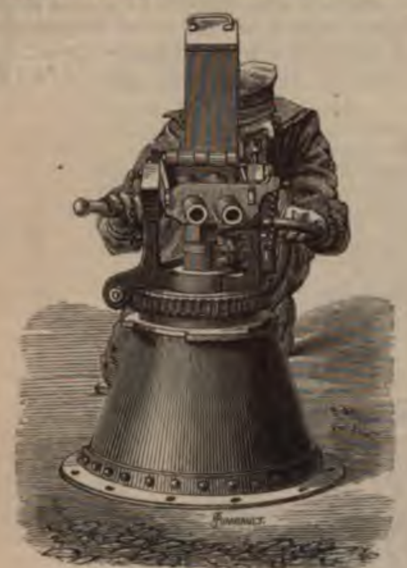
A more novel item of the Nordenfelt exhibit, which we also herewith illustrate, is the quick-firing 6-pounder gun, which is the natural outcome of machine guns, torpedo boat to complete its dangerous errand before they had taken sensible effect. We find also in the iron-clads of foreign navies that many vessels are mounting broadside guns without armoured protection, which might be manned and worked for a considerable time against lightly armed vessels, or under the slow fire of the heavy projectiles from ordinary turret guns. Six-pounder shrapnel shells would, however, render such a

carried into practice to provide a weapon suitable for piercing the iron and steel sides of unarmoured ships, or the unarmoured portions of partially protected ships.

For a defence also against torpedo boats, something more destructive than the small machine bullets is desirable, as the leaks resulting from the ordinary machine gun bullets would be comparatively small, and allow the battery quite untenable, provided the fire was rapid enough, since the shells would burst on striking the thin iron or steel plating, and soon clear away those attempting to work the guns. It is to fulfil this important function that the Nordenfelt quick-firing 6-pounder has been designed.

Its construction is exceedingly simple. It is capable

of being trained right and left, or of being elevated or depressed by a pair of hand wheels, conveniently placed for the control of the captain of the gun. The gun is provided with a breech block, which rises and falls into



position by the action of the firing handle, the exploded cartridge case being withdrawn and allowed to fall through the bottom of the breech by the same action. The new cartridge is slipped by hand into a trough in the rear of the gun, where it falls into a channel behind the bore of the gun, and is forced home into the breech by the return action of the firing handle. After the cartridge is home in the breech the breech block is mounted in place by the further movement of the handle; the gun is eventually fired by a continuation of the same movement. Care is taken in the arrangement of this mechanical movement that firing cannot possibly ensue until the breech block is locked home, and the firing handle must be put out of gear to enable the breech block to be tampered with, or removed for examination or cleaning.

This makes an excellent gun. With the Nordenfelt steel bullets we understand that $4\frac{1}{2}$ in. of iron and $3\frac{3}{8}$ in. of steel can be perforated when struck directly at 300 yards range. The carriage is particularly constructed on the principle of a parallel motion, so that the recoil is taken on the piston of a hydraulic and spring buffer. After recoil, the gun thus returns to firing position without serious alteration in the laying, and the movement is so elastic that ships' boats can easily bear the firing of the gun at a rapid rate. About 18 shots per minute can be delivered as a maximum rate without deliberate aim.

Old Cunarder Ships.—It is stated that the old Cunard steamers *Parthia* and *Batavia*, which were taken in part payment of the *Umbria* and *Etruria*, by Messrs. Elder & Co., are to be run between Montreal and the Clyde as live cattle steamers, in the interest of Mr. William Pearce, the present owner.

At the recent meeting of the Peninsular and Oriental Steam Navigation Company, the chairman, Mr. Thomas Sutherland, M.P., said that three things were required to place the shipping trade on a better footing. First, an improved feeling in the trading classes; secondly, a reasonable co-operation among shipowners; and thirdly, an abstention for a considerable time to come of the reckless shipbuilding which had been the cause of so much disorder and misfortune.

A boiler explosion has occurred on board the Norwegian steamer *Heimdal*, killing the fireman and injuring six other persons, including the captain's wife, who was seriously hurt. The steamer was considerably damaged.

The Amphion.—Considerable activity prevails on board the *Amphion*, 10, steel cruiser, in order that she may be ready for sea by the end of July. In consequence of an improved armament which has been introduced since the ship was designed and launched, several alterations are being made; and when the *Amphion* is ready for sea she will not only be one of the most powerfully armed ships in the service, but her high rate of speed, 18 knots per hour, will tend to make her a highly valuable vessel. There are at present more than 300 hands working upon her.

THE HISTORY OF PADDLE-WHEEL STEAM NAVIGATION.*

By Mr. Henry Sandham, of London.

THE origination of the propulsion of vessels by steam power is claimed for several individuals and by several countries. Spain and France both assert their precedence; but it is now generally admitted that to Great Britain is due the merit of having introduced and established the successful practice of steam propulsion.

The application of paddle-wheels to propel boats or vessels, dates back to the time of the Roman empire, and even earlier; for it is known that the Chinese, Egyptians, and Greeks employed paddle-wheels for that purpose. In the Roman vessels the wheels were probably driven by slaves through some mechanical arrangement of spindles, wheels, pulleys, and ropes, or perhaps by mere direct action of manual labour; the feet also may have been employed. A drawing is given in Cutts' "Middle Ages" of an early fifteenth century vessel propelled by oars, which were worked by slaves lying on their backs in the vessel's hull, and pushing the oars with their legs and feet. The feet were kept in position by straps, which enabled the oars, apparently balanced, to be lifted out of the water and carried back after each stroke. A rare and curious work, in twelve books, by Robert Valturius, of Rimini, "De Re Militari," published in 1472, and printed by Beughem, contains representations of boats fitted with one pair, and with five pairs of paddle-wheels.

1543.—It appears that Blasco de Garay, a Spaniard, made an experiment on propelling a vessel by mechanical power at Barcelona, in 1543, before the Emperor Charles V., who paid all expenses incurred. Nothing is known beyond the record of this experiment, and that a steam-driven machine or engine working paddles is stated to have been used to propel the "pyroscaph." The invention died with the inventor. No claim, however, is said to have been raised upon it until after the true introduction of steam power for propelling vessels.

1682.—The earliest date recorded for the application, in Great Britain, of paddle-wheels to the propulsion of vessels seems to be 1682, in which year Prince Rupert's (1619—1682) state barge was propelled by paddle-wheels. At the same period tug-vessels with paddle-wheels driven by horses, were proposed to be used for towing sailing vessels against wind and tide.

1690.—Denis Papin, a French mechanician, who was born at Blois in 1647 and died in 1714, is next recorded as having propounded the propulsion of ships by mechanical means. In 1690, he proposed to propel boats by wheels "worked by racks and pinions working in steam cylinders." This proposal does not seem to have developed beyond an idea. In 1681, however, he had already immortalised himself by the invention of the "digester" known by his name, which still continues in practical use at the present day.

1736.—On the expiration of the patent of Thomas Newcomen, of Dartmouth, for his atmospheric engine, one was taken out in 1736 by Jonathan Hulls, an English mechanician, for moving a boat by a steam engine, or rather "for the application of the atmospheric engine to actuate or propel a boat by paddles for towing vessels in and out of rivers and harbours." In 1737 he published in London a descriptive pamphlet with drawing, an original or very early copy of which is in the possession of Sir Frederick Bramwell. The proposal was to drive a fan or wheel at the stern of a boat, by a steam engine working a series of pulleys with straps or ropes passing over them; and there were arrangements for preventing a back motion of the stern-wheel.

1752.—Daniel Bernouilli (1700—1782) suggested in 1752 an arrangement of submerged artificial fins for propelling a vessel. In 1757 he was awarded a prize by the French Academy for his demonstration of the use and effect of paddle-wheels and other forms of propellers to be worked by steam power or the expanding gas of gunpowder. A propeller was exhibited at the Scientific Apparatus Exhibition at South Kensington in 1876, called the undulating propeller, the invention of A. H. Garrod, the idea of which appears to have been taken from the undulating fins of the pipe-fish and sea-horse. In 1882 a small boat was tried on the Thames with a fin propeller, the invention of C. F. Osborne. Mr. Pichler's propeller, 1860, is also of this fin class.

1753.—Through the activity of MM. Euler and Mathon De la Cour, of Lyons, France again took a prominent part in the mechanical propulsion of ships. Euler employed the vessel's crew in watches to drive an upright wooden shaft by long levers on each deck. On the top of the upright shaft was keyed a large crown wheel of wood having wooden teeth or pins which geared into a rung pinion on a horizontal shaft running across the vessel and through her sides, and carrying the paddle-wheels outside the hull. De la Cour drove his paddles by an endless rope-ladder suspended over two pulleys which were keyed on a horizontal shaft across the upper deck. The ladder was worked by men stepping on its rungs, exactly in the manner of the tread-wheel. The paddle-shafts and paddle-wheels were made to revolve by means of ropes from pulleys on the ends of the main shaft to pulleys on the paddle-shafts, which with their wheels were run out of the ship's side about her draught line. The shafts and wheels could be shipped or unshipped at will. In 1755 Canon Gautier, of Nancy, presented to the Royal Society of that place a paper on the proposals of MM. Euler and De la Cour, maintaining that the strength of the vessel's crew, working their machinery, would not be sufficient to give any great speed to a ship. As the only means of obtaining the requisite power, he proposed employing a steam engine; and pointed out several ways of doing so, and thereby of producing rotatory motion of the paddle-wheels. Practically, however, at that time the steam engine had not yet arrived at the stage in which it could be conveniently applied to the propulsion of vessels. Two conditions were wanting to adapt it to this purpose: namely, rotatory instead of simple reciprocating motion, and continuous instead of intermittent motion of the engine itself.

1782.—The Marquis de Jouffroy, at Lyons, in 1782, constructed a steamboat which ran for fifteen months on the river Saône. She was 140 ft. long, 15 ft. wide, and drew 3·2 ft. of water. She had a horizontal single-cylinder engine, the cylinder being placed inside the boiler for warmth, as was subsequently done by Trevithick. Motion for the paddles was obtained by means of an iron frame sliding backwards and forwards with the engine stroke. To the top and bottom bars of the frame were attached double sets of pauls; and on the paddle-shaft, which ran through the frame, two cam-wheels were fixed. In the outstroke of the engine the cam-wheels were pushed by the pauls on the top of the frame, and in the instroke were pulled by those on the bottom, whereby an intermittent rotation was imparted to the paddle-wheels. In the South Kensington Museum is a sketch of this steamboat, lent by Mrs. Bennet Woodcroft, copied from a French print. The Comte d'Auxiron, a French nobleman of scientific pursuits, is also mentioned as having previously constructed a steamboat in 1774, and tried it on the Seine; and 1775 M. Perier is said to have placed on the Seine a steamboat which had an engine of one H.P.

1782.—James Watt, who was born in 1736 and died in 1819, perfected in 1782 his double-acting condensing steam-engine, continuous in its working, and controlled by the governor. This achievement opened out an entirely new and perhaps never-ending career for the steam engine. The fly-wheel on the main shaft secured the continuous action; while the crank, seemingly an invention of Watt, supplied a simple and practical means of converting reciprocating into rotary motion.

1786.—This year forms another epoch in the propulsion of vessels by paddle-wheels. Patrick Miller, of Dalswinton, in Scotland, had been experimenting for some time on the propulsion of boats by paddle-wheels worked by manual labour. In the Kensington Museum there is a coloured engraving, lent by Mrs. Bennet Woodcroft, of the *Edinburgh*, a triple-hulled vessel, designed by him and built in 1786 at Leith; she appears to have been 71 ft. long, with 21½ ft. extreme breadth, and 3 ft. depth of hulls. Her paddle-wheels were 6 ft. diameter, and 4½ feet in breadth; they had eight float-boards, 4⅞ ft. long, 9 in. deep. The wheels were turned by manual labour, as depicted in the engraving; they were set between two of the three hulls, one ahead of the other, and were housed in. The vessel was fitted with three masts, square rigged. As, however, she did not prove satisfactory, Miller was advised by his sons' tutor, James Taylor, to turn attention to the steam engine for the propulsion of his vessel. Accordingly, in 1786-7 he entered into negotiations with William Symington, an engineer and mechanic at the Wanlockhead Lead Mines, N.B., who in 1787 patented "his new invented steam engine on principles entirely new." Symington was to fit one of his new invented steam engines into a double-hulled boat of Miller's then on Dalswinton Lake. The boat was 25 ft. long, 7 ft. wide. Her steam engine, under Symington's directions, was made in brass by George Watt, founder, Low Calton, Edinburgh. In October, 1788, the completed engine was placed in the boat, and connected to two paddle-wheels, driven with intermittent motion by rod and chain work attached to ratchet-wheels on the paddle-wheel shafts. The paddles were placed fore and aft in the boat's length. When

* *Read at a Meeting of the Institution of Mechanical Engineers, March* 20.

the boat was started under steam a speed of five miles per hour was recorded. Symington's engine is now in the Kensington Museum, the property of Mrs. Bennet Woodcroft; it was re-instated in 1854 for the late Mr. Woodcroft by Mr. John Penn, and has been actually under steam. The engine is a single-acting double-cylinder engine; the two cylinders with open tops are only about 4 in. diameter, and the stroke is about 9 in. For a considerable period after the success of this steamboat on Dalswinton Lake nothing important seems to have transpired towards developing steam navigation.

1801.—William Symington, however, was employed in 1801 by Lord Dundas, Governor of the Forth and Clyde Canal, to construct a steamboat to be used on the canal for towing the "sloops." In 1802 the *Charlotte Dundas* steamer was turned out, having a stern paddle-wheel driven by a double-acting horizontal engine with cylinder 22 in. diameter and 4 ft. stroke. In March, 1802, she towed on the canal two loaded sloops of 70 tons burden each, accomplishing 19½ miles in 6 hours against a head wind. Her career, however, was then stopped, through fear lest the canal banks should suffer destruction from the agitation of the water by the stern wheel. The speed when not towing reached six miles per hour. Her success induced the Duke of Bridgewater to give Symington an order for eight similar boats for service on his canal in England, but owing to the duke's sudden death the order was never carried out.

1801.—Charles, Earl Stanhope (1753-1816), in 1801 endeavoured to apply the duck's foot propeller, proposed 1752-3 by the Swiss inventor Genévois. It was revived in 1882, when a steam launch fitted with this class of propeller, proposed by Mr. Welton, was exhibited at the Naval and Submarine Engineering Exhibition at the Royal Agricultural Hall, Islington, London.

1807.—Robert Fulton (1765-1815), an American engineer, is said to have visited, inspected, and tried Symington's steamboat in 1802, and to have taken careful notes of her machinery. In 1803 experiments of his in France, with a steamboat on the Seine, are recorded as taking place. In August, 1803, he is stated to have given an order to James Watt, Soho Works, Birmingham, for an engine of 20 H.P. for a vessel called the *Clermont*, to be built in America. The diameter of the cylinder of this Soho engine was 24 in., and the stroke 4 ft. The principal parts of the engine were forwarded to America in 1805. The vessel, her paddle-wheels and gear, and the subordinate parts of the engine, were designed and executed by Fulton himself. The steamer, completed in 1807, was 133 ft. long and 18 ft. wide, or nearly 7⅓ times as long as she was broad, with 9 ft. depth of hold. She ran from New York to Albany, 150 miles, in 32 hours, and returned in 30 hours. After this trip she was advertised as a regular passenger and cargo trader between New York and Albany, and steamboats were thus established in America. Another steamer, the *Car of Neptune*, had a length of 7·44 times her breadth.

In America steam navigation was pushed on so energetically that in 1818 a steamer for ocean service, the *Savannah*, was turned out, of 100 ft. length and 26 ft. breadth, or 3·84 times as long as broad, and drawing 14 ft. of water loaded. She was sent to St. Petersburg, and returned to New York. In connection with St. Petersburg it should here be mentioned that Mr. Charles Baird, an English engineer established there, fitted a Russian-built barge with steam machinery and paddle-wheels in 1815. A drawing of this vessel exists in the Museum at Kensington, which portrays the boiler as set in brickwork with a brick-built smoke-stack; whilst the paddle-wheels, having each two floats only, were fitted with gear for feathering the floats. The engine had a fly-wheel on main shaft, and drove the paddles by geared wheels.

1811.—In this year the celebrated British steamer, the *Comet*, was built at Glasgow by J. & C. Wood, for Henry Bell, an hotel-keeper at Glasgow. She was a wooden vessel 40 ft. long on the keel, 10½ ft. beam, and 25 tons burden. The machinery was made in 1812 by John Robertson, of Glasgow, who died in 1868 at the age of eighty-six. The engine is preserved in the Patent Office Museum. It is a table condensing vertical engine of 3 to 4 N.H.P., and is fitted with the bell-crank motion of James Watt, for driving. The *Comet* had originally four paddle-wheels, two on each side of the hull, fore and aft of the centre of her length. Ultimately she was propelled by two wheels only, one on each side; the speed was five miles per hour. She plied between Glasgow and Helensburgh.

1813.—A larger steamer than the *Comet* was this year launched on the Clyde, named the *Elizabeth*. She was 58 ft. long "aloft" (over all), and 11 ft. broad amidships. She plied regularly twice a day between Glasgow and Greenock, at one-third of the fares charged by the stage coach.

1814.—Five steamers are recorded as running on the Clyde in 1814, whilst it would appear that ten steamboats had been turned out with success. Up to this time no steamer is mentioned as at work on the Thames. One at Bristol is spoken of, which plied thence to Bath, and was afterwards sent to the Thames by inland navigation. The opposition she met with, however, from the craft of the Thames watermen obliged her to return to Bristol.

1815.—A Clyde-built wooden steamer, the *Margery*, was sent to the Thames in the summer of 1815, and began a regular service, once down and once up daily, between London and Gravesend. She was built by J. & C. Wood, of Glasgow, in 1813, was of 70 tons burden, and had one engine of 14 N.H.P. This is the first regular passenger steamer on the Thames on record.

1815.—The *Margery* was followed by another wooden steamer built by J. & C. Wood, at Glasgow, called the *Argyle*, which came to the Thames from the Clyde, round the Land's End. She was of 74 tons burden, 65 ft. long on the keel, 14½ ft. beam, with 3½ ft. draught of water. Her paddle wheels were on the first motion of the 16 H.P. engine, and consequently were driven direct by it. They were 9 ft. diameter 4 ft. wide, with six floats in each wheel, 15 in. broad. The average speed was seven miles per hour. She was re-christened the *Thames*, and plied between London and Margate.

1816.—The steamer *Caledonia*, built by J. & C. Wood, of Glasgow, was brought to the Thames. She was 94 ft. long between perpendiculars, extreme breadth 15½ ft., depth of hold 9 ft. She had a flat floor, and square bilge. She was fitted with two engines, said to be by Boulton and Watt, one for each wheel: the first steamer recorded as fitted with two engines. They were together of 32 N.H.P., and had cylinders 23 in. diameter, and a stroke of 2½ ft. The paddle-wheels were 13 ft. diameter. James Watt afterwards bought the *Caledonia* for his own purposes, and fitted her out with new machinery and wheels. On 15th October, 1817, he took her from Margate to the Scheldt and reached Rotterdam, whence on 23rd October he took her up the Rhine, arriving at Coblenz on 13th November. Owing to the shallowness of the river she was not able to proceed further up. She is said to be the first steamer ever run on the Rhine; and was finally sold to the King of Denmark.

1817.—Elias Evans, a shipwright, of Frinsbury, near Rochester, coming thence to London in 1815, designed and built on the Thames some small schooners and sailing vessels, and soon turned his attention to the construction of steamers. In 1817, he launched the *Sons of Commerce* steamer, 85 ft. by 25½ ft. by 8 ft., of 77 tons burden; mean draught of water 3½ ft.; engines by Boulton & Watt of 20 N.H.P.; diameter of cylinders 26¾ in., stroke 2½ ft.; diameter of paddle-wheels 10 feet. She was followed by the *Favorite*, *London*, and *Diana*; and by a vessel called the *Victory*, which ran to Margate in 1818 with the *Favorite*.

1818.—David Napier, of Glasgow, in 1818 built a sea-going steamer, the *Rob-Roy*, of 90 tons burden. The vessel plied regularly between Greenock and Belfast, and afterwards ran between Dover and Calais.

1821.—Evans built the earliest steam vessels recorded for the royal mail service. They were the *Lightning*, 205 tons, 80 N.H.P.; and the *Meteor*, 189 tons, 60 N.H.P. They both ran between Holyhead and Dublin. The *Meteor* was 126 ft. long between perpendiculars, 22 ft. 4 in. extreme beam, 13 ft. 8 in. depth of hold.

In the same year (1821), Evans turned out the *Union*, 75 ft. long, and 12½ ft. extreme breadth, with 7 ft. depth of hold, and 53 tons burden, having a single engine only. She was speedily followed by larger and more powerful vessels for coast voyages; the *City of Edinburgh*, built by Wigram & Green, of Blackwall, for the London and Leith trade; and the *James Watt*, built by J. & C. Wood, of Glasgow. The *City of Edinburgh* had a pair of engines by Boulton & Watt of 80 N.H.P. Her wheels were on the second motion from the engine, 18 ft. diameter, 8 ft. wide, each with 16 floats of 2 ft. breadth. Blow-out pipes, brine pumps, and bilge injection are said to have been first applied in this vessel. The *James Watt* was 141½ ft. by 25½ ft. by 16½ ft., tonnage 420. The form of her hull was deemed an advance, her greatest transverse section being amidships; and all her floors crossed the keel, so that she had no half-floors. She had two engines of 100 N.H.P. together; her wheels were on the second motion, and were 18 ft. diameter and 9 ft. wide, with 16 floats of 24 in. breadth. At 10½ ft. draught of water the speed was determined as 10·03 miles per hour.

In 1821, the *Medusa* steamer, built by Evans, should be noted as the earliest that is mentioned as having oscillating engines; the original invention, in 1785, it is said, of William Murdock. Goldsworthy Gurney (1793—1875) effected substantial improvement in oscillating engines in the early part of the present cen-

tury; and Joseph Maudslay, by his construction of them in 1827, under the title of improved vibrating engines, firmly established their reputation.

Steam vessels now appeared with great rapidity all round Great Britain; and also in Ireland—the City of Dublin Steam Packet Company being founded in 1824, whose first steam vessels were the *Mersey* and the *Liffey*.

LONG-VOYAGE STEAMERS.—In 1825 the first steamship voyage to India took place. The *Falcon* sailing vessel, 84 ft. by 22 ft. by 11½ ft., 176 tons burden, was fitted with paddles and steam machinery as auxiliaries to her sail-power. She arrived at Calcutta safely, and was bought by the East India Co.

The *Enterprise* steamer, 122 ft. by 27 ft., 470 tons, 120 N.H.P., having an average speed of 8·79 miles per hour, left England in August, 1825, for Calcutta. She reached her destination in 113 days all told; 103 days actually under steam, 10 days being consumed for renewals of fuel. Her commander, Captain Johnson, is said to have received a present of £10,000 for this successful voyage; the Indian Government bought the steamer for £40,000.

In 1829-30 the *Hugh Lindsay* steamer, built at Bombay, 411 tons, 160 N.H.P., carrying 5½ days' coal, with 11½ ft. draught of water, made a voyage from Bombay to Suez and back. This vessel's performances led to the establishment of the regular mail service between England and India, *viâ* Alexandria and Suez.

1830.—A service of paddle steamers was begun on 5th February, 1830, between Falmouth, Malta, and Corfu, at that time with the Ionian Islands a British protectorate. The *Meteor* Government steamer first conveyed the Mediterranean mails from Falmouth, which had previously been taken by sailing vessels. She was very quickly assisted by eight other steamers, the *Echo*, *African*, *Carron*, *Columbia*, *Confiance*, *Firebrand*, *Hermes*, and *Messenger*. The longest passage out and home occurred in 1831, namely 55 days, by the *Meteor*; the shortest was also in the same year, 36 days, by the *Messenger*. The sailing packets had required an average of three months to perform the out voyage from Falmouth to Corfu only.

1837.—It appears that in this year Government contracted with the Peninsular Steam Navigation Company for a definite service of steamers to carry mails from Falmouth weekly to Vigo, Oporto, Lisbon, Cadiz, and Gibraltar. In 1834 the Admiralty were directed to arrange for a monthly extension to Alexandria of the existing Malta and Corfu service; the extension was carried out completely in February, 1835. The *Hugh Lindsay* was to be sent at stated periods to and from Suez and Mocha with the mail, and to be assisted by the steamers *Atalanta*, 616 tons, double engines of 210 N.H.P.; and *Berenice*, 664 tons, having two engines of 115 N.H.P. each. Both these vessels carried one long gun; they were to run regularly to and from Mocha and Bombay. In 1840-43 the present Peninsular and Oriental Steam Navigation Company had completed arrangements with the home and Indian authorities for the Indian mail service, with steamers of not less than 400 N.H.P. In 1843 the service was extended to Calcutta; in 1845 to Ceylon and Madras; and in 1847 to China.

ROYAL NAVY.—Here may be mentioned the following steam frigates with paddle-wheels and wooden hulls, built for the royal navy, and celebrated for long and valuable service.

1825.—The *African*, 295 tons, 90 H.P., built by Sir R. Seppings. The *Avon*, 361 tons, 170 H.P., built by Graham. The *Kite*, 300 tons, 170 H.P.; and the *Lucifer*, 387 tons, 180 H.P., built by Messrs. Humble and Hurry.

1834.—The *Blazer*, 527 tons, 120 H.P., and the *Tartarus*, 523 tons, 136 H.P.; both built by Sir William Symonds.

The *Gorgon*, built in 1837, by Sir Wm. Symonds; 1,111 tons burden, 320 N.H.P.; engines by Seaward on a new plan introduced in 1839, and ever since known as the *Gorgon* engine.

The *Cyclops*, built in 1839, by Sir Wm. Symonds; 1,195 tons burden, 1,862 tons displacement, 320 N.H.P.; engines by Seaward. These engines of Seaward established the *Gorgon* type of marine engine.

The *Penelope*, originally designed for a 46-gun sailing frigate, in 1843 was cut in two at Chatham Dockyard, drawn asunder, and lengthened about 63 feet, to receive engines, boilers, and machinery: perhaps the earliest wood-built vessel thus treated. When lengthened she measured 245 feet in length, and 1,780 tons burden. Her engines were of the direct-acting or *Gorgon* type, 700 N.H.P. Their total weight with boilers and paddle-wheels was 435 tons.

The *Retribution*, built in 1844, by Sir Wm. Symonds; 1,641 tons burden, 800 N.H.P.; engines by Maudslay & Field, on the double-cylinder system with ⊤ cross-head introduced by Joseph Maudslay in 1841.

The *Terrible*, built in 1845, by Oliver Lang; 1,850 tons burden, 800 N.H.P. Her engines, by Maudslay & Field, were similar to those of the *Retribution*.

The *Tiger*, built in 1849, at Chatham, by Mr. J. Edye; 1,221 tons burden, 400 N.H.P. Her engines, it is believed, were by Seaward. During the Russian war in 1854 she grounded at Odessa in a fog, was surrendered to the enemy, and was sunk by them.

The *Janus*, built in 1844, by Lord Dundonald; 763 tons burden, 200 N.H.P. The ship, her boilers, engines, and machinery, were all designed by Lord Dundonald himself. She was built at Woolwich, or Deptford, it is believed. The *Janus* had bow and stern alike sharp, and was capable of going either end first at equal speeds, to avoid turning. Her hull sections were similar semi-ellipses. She was the earliest vessel arranged to go either end first; and had rudders capable of forming part of the ship's structure when not wanted for steering. This system, fore and aft ends alike, was afterwards greatly developed for paddle-wheel gun-boats.

It is worth noting that the first steamer in the royal naval service was the *Monkey* paddle-wheel tug, built at Rotherhithe, in 1821, by Evans; 212 tons burden, 80 N.H.P.

The next was the *Comet*, built at Deptford, in 1822, by Oliver Lang; 238 tons burden, 80 N.H.P.

The third was the *Sprightly*, built at Blackwall, in 1823, by Wigram & Green; 234 tons burden, 100 N.H.P.

The fourth was the *Meteor*, built at Woolwich, in 1824, by Oliver Lang; 296 tons burden, 100 N.H.P.

In 1845 the *Odin* and the *Sidon*, designed by Sir Charles Napier, were the first steam paddle-frigates carrying guns on the main deck broadside. The *Odin* had direct-acting engines of 590 N.H.P. by Fairbairn & Co. The *Sidon* was fitted with tank coal-bunkers; as the coal in them was used up, the tanks were filled with water from the sea; thus the vessel could be maintained at a mean draught of water.

Paddle-boxes covered by life-boats or other ships' boats, were proposed by Capt. G. Smith in 1838, and again about 1840 by three officers of H.M. dockyards, Messrs. Burr, Peake, and O. Lang. Of the three it would appear that Mr. Peake has chief credit both for originating and for maturing the idea. The securing and the launching of the boats on the tops of the paddle-boxes gave rise to much scheming. The *Penelope*, *Retribution*, *Terrible*, and *Tiger*, with many other paddle-frigates, were fitted with paddle-box boats.

In 1848, Mr. R. Taplin, of Woolwich Dockyard, brought out the telescopic funnel or smoke-stack adopted for the royal navy. He had previously, about 1827, designed a steam-superheating apparatus for boilers.

Mr. G. Dodd, in 1817—18, also devised a plan for lowering funnels, and applied it to Thames steamboats. He also proposed dividing the hulls of steamers into compartments by bulkheads of iron.

OCEAN STEAMERS.—Of British Atlantic Ocean paddle-wheel steamships the earliest recorded were:—

The *Curaçoa*, built about 1827 in England, and purchased by the Dutch Government; 400 tons burden, fitted with two engines of 50 N.H.P. each. She went a voyage from Helveötsluys to Surinam in 27 days 11 hours, consuming 7·14 lbs. of coal per H.P. per hour.

The *Royal William*, built in 1832, of 1,200 tons and 180 N.H.P. She came from Picton, Nova Scotia, to Portsmouth, in 20 days. She was built at Quebec, to run for a steam-packet company between Halifax and Quebec. Her engines were made at St. Mary's Foundry, Montreal. She was eventually sold to the Portuguese Government.

The *Great Western*, promoted by Captain Claxton, R.N., and built, in 1835, at Bristol, by Patterson; engined by Maudslay & Field. Her wheels were constructed on the cycloidal system devised by Joshua Field in 1837-8. Length between perpendiculars 212 ft., over all 236 ft.; extreme breadth, 35 ft. 4 in.; depth of hold, 23¼ ft.; load draught, 16 ft.; 1,340 tons burden; side-lever engines of 400 N.H.P. The *Great Western* was fitted out at London, and sailed thence for Bristol and New York, 31st March, 1838; speed attained 12·88 miles per hour. This celebrated vessel was broken up in 1858.

The *Sirius*, built in 1838 by the St. George Steam-packet Co., was afterwards chartered by the British and American Steam Navigation Co. to run to New York till their own vessel, the *British Queen*, was ready. She left Cork on her first Atlantic voyage on 4th April, 1838, and arrived at New York on 22nd April.

The performances of the *Great Western* and *Sirius* led Mr. Cunard to come over to England from America in 1839, and

start the celebrated Cunard line from Liverpool. The *Acadia*, *Britannia* and *Caledonia* steamships were built for this line by J. and C. Wood, of Glasgow and Greenock. Their dimensions were: 206 ft. long between perpendiculars, 34½ ft. extreme breadth; 22½ ft. depth of hold; 1,139 to 1,155 tons burden. Their engines were constructed by Robert Napier, of Glasgow, on his side-lever system, and ranged from 440 to 450 N.H.P. The cylinders were 72 in. diameter, stroke 6 ft. 10 in. Their wheels 28 ft. diameter. The tonnage was respectively 2·58, 2·57, and 2·53 times the N.H.P. in the three ships.

(To be continued.)

Miscellaneous.

At the recent meeting of the East and West India Dock Company, the chairman stated that the total cost of the Tilbury Docks would be a little over £1,500,000.

The Tilbury Docks were on June 10th visited by a company of the members of the Society of Engineers. It is said the work will be completed by the end of the year.

A screw boat 80 ft. long, 16 ft. wide, and 7 ft. deep, has recently been launched on Lake Mille Lacs, Minnesota. It is the first steam vessel that has appeared on these waters, and is to be used for towing logs. The engines are 100 H.P. The vessel is strongly built to withstand the rough water of this inland sea.

The manœuvres of the German navy are this year to be conducted on a grander scale than was ever before attempted. About twenty large vessels and a number of torpedo boats will be concentrated off Wilhelmshaven. A squadron assembled at Kiel in the first week of August will execute naval evolutions in the Baltic. Fifteen torpedo boats will also be concentrated at Kiel.

Visit of the Hull and District Institution of Engineers and Naval Architects to the Hull Alexandra Dock.—Accepting an invitation of Mr. George Bohn, the members of the above Institution recently paid a visit to the Alexandra Dock. The members were accompanied by the first President of the Institute, Mr. M. Samuelson. On their arrival at the new dock, the masonry of which is now nearly completed, they were taken in charge by Mr. Bohn (the acting engineer) and Mr. Hertzig (the resident engineer). They were conducted round the western quay, near which a large iron transhipment shed and warehouse is rapidly approaching completion. Various portions of the shipyard were inspected, and at the huge entrance gates it was found that a number of men were giving them the finishing touch. The hydraulic machinery by which these gates will be worked has been placed in position. The water to be pumped in will be taken in the first instance from the Barmston drain, and when it has attained to a certain level the caisson will then be removed and placed in an opening at the south-east end of the dock, thus blocking for a time, and so long as it is required, a channel which is being cut to the fish dock, powers to construct which have already been granted to the Hull and Barnsley Railway and Dock Company. From the entrance lock the party went along the sea-wall to the eastern end of the dock, and were next taken to the pumping station, where they were shown the boiler house. Two of Gwynne's pumps are here employed. These have been so arranged that they may be both put on to pump the water out of one graving dock, or one pump may be at work at the same time on each of the graving docks. The largest of the docks is 500 ft. long, and the pumps are of such power that one of them will empty this dock in three hours. It is intended to open the dock and railway in July.

A scheme is on foot at Sydney, New South Wales, to connect the city with the north shore at Balmain by means of a tunnel under the harbour. The tunnel will be about 6,000 ft. long, and will be in two parts, on the same level—one for a railway, and the other for foot passengers and ordinary street traffic. The total cost of the undertaking will be £400,000, the Government guaranteeing 4 per cent. interest on that amount. After a certain number of years, the works, on paying off all claimants, will pass into the hands of the Government.

The sufferers by the explosion which occurred in the coal bunkers of H.M.S. *Inflexible* at Portsmouth remain at Haslar Hospital, where they are making steady progress towards recovery, with the exception of one stoker, who was in the bunker when the explosion occurred, and whose condition is serious.

Mr. C. H. Wordingham, in a paper on "Lighthouse Construction," and dealing principally with those structures which are built far out upon exposed rocks, like the Eddystone and Skerryrose, and which have to stand the full force of the heavy seas thrown up by winter storms, draws attention to the desirability of measuring the force of such waves by a marine dynamometer in different directions and at different heights, as being the only method of obtaining the necessary data for determining the shape of towers.

Sir Edward J. Reed, in a lecture on the "Forms of Ships," called attention to and explained the character of those investigations which have been conducted by the late Dr. William Froude under the patronage of the Admiralty. Sir Edward stated that it was a common error to judge of the merits of steamships by the relations which exist between their displacement, steam power, and speed, as expressed by formulæ of various kinds. He pointed out the necessity of great changes in the forms of steamers and war ships. In the latter a great deal of beam was desirable, in order that the vessel might more readily bear the increasing thickness of side armour, which the exigences of the times were compelling nations to adopt; and that this increase of beam had been discovered by Dr. Froude to facilitate the attainment of very high speed, combined with invulnerability to shot.

Berehaven, which was the scene of the experimental operations of the particular service squadron, is a well-sheltered anchorage lying between Bere Island and the north shore of Bantry Bay. It may be entered at either side, and at any time of tide, by iron-clad ships of any draught. Within the harbour the anchorage is clear and deep, under the shadow of craggy gray limestone cliffs, varying from 300 to 3,000 ft. in height.

The cutter yacht *Genesta* has left this country for New York in order to sail in the matches for the winning of the Queen's Cup, which the American yacht *America*, the first of centre-board yachts, took away from England in 1861. The *Genesta* carries a very large spread of canvas, and it is expected she will make a fast passage across the Atlantic.

Up to the 17th June the Suez Canal authorities had not succeeded in clearing away the wreck of the dredger sunk in mid-channel near Kantara. After trials with dynamite they had sent to the Egyptian Government for half a ton of gunpowder for further operations. A channel for ships is being cut round the obstruction.

In a paper read at the Institution of Civil Engineers, by Professor Reynolds, on "The Theory of the Indicator and on Errors in Indicator Diagrams," it was shown that there were five principal causes of disturbance—namely, the inertia of the piston of the indicator and its attached weights; the friction of the pencil on the paper and its attached magnetism; purring action of the spring; inertia of the drum; and friction of the drum. The error which such oscillations and defects caused in the area of the diagram depended on their magnitude, and to a greater extent on the smallness of the numbers in a revolution. But the evil of these oscillations was not so much an effect on the area, as in the disfigurement, and the confusion they produced in the diagram. The friction of the drum with an elastic cord caused the cord to be longer during the forward stroke than during the backward stroke, so that the diagram was distorted and shortened, the drum being uniformly behind its proper position during the forward stroke, and before its position during the backward stroke.

Her Majesty's ship *Leander*, one of the swiftest cruisers in the service, on entering Bantry Bay during the evolution of the squadron, mistook the deep-water channel, and grounded upon a hard bottom, sustaining such injuries that the pumps had to be called into requisition. The weather was, at the time, thick and squally, with a strong N.W. wind. A later telegram brought a report of the divers, to the effect that the vessel had a rent in her bottom 5 ft. in length, with a bad scratch upon her keel some 40 ft. long. The bilge is injured in a similar manner to the extent of 50 ft. Canvas savealls were immediately passed under the vessel to stay the great inrush of water, and the report states that the ship was beached upon a mud bank to save her from foundering.

The Admiralty have authorised a protracted series of trials of anchors at Portsmouth, which are being carried out under the superintendence of the Captain of Steam Reserve and Chief Constructor. It is now many years since a similar trial took place, during which time many new forms were introduced and old methods improved upon. In the tests, the Admiralty anchor is accepted as a standard of comparison. The Martin, Baxter, Tysack, and Englefield anchors have already been put to a preliminary trial, and there are still some more patterns to try.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of The Marine Engineer *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—Ed. M. E.]

LAUNCHES—English.

Actor.—On May 30th there was launched from the yard of her builders, Messrs. Raylton Dixon & Co., a steamer named the *Actor*, which has been built to the order of Liverpool owners. She is built of Siemens-Martin steel, from the works of Messrs. Bolckow, Vaughan & Co., at Eston. Her leading dimensions are —260 ft. length over all; breadth, 34 ft.; depth, moulded, 23 ft. 8½ in.; and she has a deadweight carrying capacity of about 2,150 tons. She is built on spar-deck rule, has deckhouse aft for cabin accommodation, and will in every way be fitted as a first-class merchant steamer. Her engines, which are on the new triple expansion principle, by Messrs. Blair & Co., of Stockton, are of 140 N.H.P. On leaving the ways she was christened the *Actor* by Mrs. Hutchinson, of Ayton.

Willesden.—On May 30th Messrs. W. Gray & Co. launched from their yard a fine screw steamer of the following dimensions: —285 ft. by 37 ft. 2 in. by 21 ft. 8 in. moulded, to carry about 3,000 tons, built of steel, to the order of Messrs. Watts, Ward & Co., London and Newcastle, and classed 100 A1 at Lloyd's. The vessel is of the well decked type with poop aft, containing handsome saloon and cabins for officers and a few passengers; long raised quarter-deck connected to bridge amidships, the latter being carried over the machinery space; coal bunkers and main hatch right forward of the foremast, thus covering in the lowest part of the vessel, and adding greatly to her strength and stability. The crew are housed in the forepart of this extended bridge, which will add much to their comfort. The usual topgallant forecastle is fitted forward with Emerson, Walker & Co.'s patent combination capstan windlass. She has five hatches and four steam winches, donkey boiler, and water ballast in double bottom under each hold, and is in every respect well equipped for general trading. The engines, which are on the three cylinder triple expansion principle, are being supplied by Messrs. Blair & Co., limited, Stockton-on-Tees. The christening ceremony was gracefully performed by Mrs. Thos. Appleby, of Ashfield, Greatham, the vessel being named *Willesden*. The vessel and machinery have been superintended during construction by Capt. Hodgson and Mr. Alchin, on behalf of the owners.

Countess.—On May 30th Messrs. Short Brothers launched from their yard at Pallion, Sunderland, a screw steamer, built to the order of Messrs. Taylor & Sanderson, of Sunderland, making the thirteenth steamer built by Messrs. Short Brothers for the same owners. The length of the vessel is 275 ft., with a breadth of 40 ft., and a carrying capacity of about 3,150 tons. She is constructed with cellular double bottom throughout, has six water-tight bulkheads, four cargo holds, with powerful steam winch at each hatchway; Clarke, Chapman & Co.'s windlass, Hastie's patent steam steering gear amidships, and their screw gear aft, and all the latest improvements for the working of the vessel. On leaving the ways she was named *Countess*, by Mrs. Dawson, of Sunderland. The vessel is to be fitted with engines and boilers of 160 N.H.P. by Messrs. Carr & Co., Limited, Sunderland, and when completed will be commanded by Captain Cook.

Brixham.—On May 30th there was launched from the shipbuilding yard of Messrs. Boolds, Sharer & Co., Pallion, Sunderland, an iron screw steamer, built to the order of Messrs. F. W. Baddeley & Son, of Brixham, Devon, of the following dimensions, viz.:—Length over all, 190 ft.; breadth, 27 ft. 3 in.; depth, 14 ft. The vessel has a full poop, bridge, and topgallant forecastle. She is fitted with three powerful steam winches and an extra large donkey boiler, Lynn's patent steam steering gear, and the Acme patent ventilator for ventilating the holds. The steamer will be supplied with all the most modern improvements in both hull and machinery, and in appliances for the speedy despatch of cargo and otherwise minimising labour. She is specially adapted for the fish, fruit, cattle, and general trades. After the launch the vessel was towed to Mr. John Dickinson's quay to receive her engines, which are of the compound principle, with improved starting and reversing gear, having cylinders 24 in. and 48 in. diameter, with a stroke of 33 in. The boiler is of extra large size, and made of steel, with a working pressure of 90 lbs. The vessel and engines have been built under the personal superintendence of Mr. Albert W. Doxford, Sunderland. The ceremony of naming the vessel *Brixham* was performed by Mrs. Edmund Sharer, wife of one of the builders.

Rosalind.—On June 12th there was launched from the Low Walker shipbuilding yard of Sir W. Armstrong, Mitchell & Co., a steel paddle steamer, which is the first of three the builders have in hand for the River Thames Steamboat Company. The vessel, which is named the *Rosalind*, is 100 ft. long, 14 ft. beam, and her draught of water is 2 ft. 9 in. The *Rosalind* will be fitted with compound surface-condensing engines by Messrs. R. & W. Hawthorn.

Glenesslin.—On June 12th Messrs. Thomas Royden & Sons launched from their building yard, Liverpool, a magnificent iron sailing ship, built to the order of Messrs. J. R. De Wolf & Son, of the following dimensions:—Length, 252 ft.; breadth, 39 ft.; depth, 23 ft. 3 in.; and will register about 1,670 tons. The vessel has been built under special survey of Lloyd's surveyors, and her scantling is considerably in excess of the requirements of that register. She is fitted with all modern improvements, and will take the highest class at Lloyd's. The ship was gracefully launched by Miss Ward, of Sheffield, and as she left the ways was christened the *Glenesslin* by Mrs. John De Wolf. She will be commanded by Captain Jonathan Firth, and will be placed on the berth at once for Melbourne.

Midnatssol.—On June 13th there was launched by Messrs. W. Gray & Co., from their yard, a steel sailing barque of the following dimensions:—220 ft. by 35 ft. 6 in. by 21 ft. 6 in., and about 1,240 tons gross register, built to the order of F. Smith Petersen, Esq., Grimstadt, Norway, and other Norwegian owners, having the highest class at Lloyd's and Norske Verikis registeries. The vessel, which is handsomely modelled, has a full poop, with accommodation for captain, officers, and a few passengers, a large house amidships containing donkey boiler, steam winch, &c., and comfortable apartments for the crew. The forepart is protected by a topgallant forecastle, with Emerson and Walker's patent combination capstan windlass. A fire-engine pump is fitted forward, with pipes leading throughout the vessel, and all through she is well found in everything necessary for sailing her and working cargo. The christening ceremony was gracefully performed by Miss Bernhardine Nielsen, daughter of Capt. C. E. Nielsen, the vessel being named *Midnatssol*. During construction the vessel has been superintended by Capt. C. E. Nielsen, one of the owners, who will also take command of her.

Halewood.—On June 13th there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt & Co. at Southampton, an iron sailing ship of 2,100 tons nett register, and of the following dimensions:—Length, 274 ft. 3 in.; breadth, 40 ft. 1 in.; depth of hold, 24 ft. 9 in. The vessel has been built to the order of Messrs. R. W. Leyland & Co., of Liverpool, and exceeds the highest requirements of both Lloyd's and the Liverpool Underwriters' Registry. She is full-rigged and fitted with skysail on mainmast. Ample accommodation is provided for captain and officers in full poop, and a large iron deckhouse is fitted amidships for petty officers and crew. She is fitted with Emerson, Walker & Thompson Brothers', Limited, patent combined capstan windlass for working anchors and chains. On leaving the ways she was christened the *Halewood* by Miss Mary Jonas.

Walter de Lancy.—On June 13th there was launched from the yard of Messrs. John Priestman & Co., Southwick, Sunderland, an iron screw steamer, of the following dimensions:—Length, 200 ft.; breadth, 30 ft.; depth, 14 ft. She has a long raised quarter-deck and bridge amidships, water ballast tanks are fitted in both holds, and she will carry about 1,100 tons deadweight. The engines, which are of the compound surface-condensing type, are by Messrs. Thomas Clark & Co., of Newcastle. The vessel is to be schooner rigged, and fitted with all the latest improvements, steam winches, Emerson, Walker, & Thompson Bros'., Limited, patent windlass, steering gear, &c., and will receive the highest class at Lloyd's, viz., 100 A1. The vessel received the name of *Walter de Lancy* from Miss Lillie Priestman.

City of Lincoln.—On June 13th Mr. Richard Day launched, from his yard at Hull, a trawling smack, for the firm of Simpson and Bowman, of Hull, smackowners. As she left the ways she was christened the *City of Lincoln* by Mrs. R. Simpson. The *City of Lincoln* is 71 ft. on the keel, 20 ft. 7 in. beam, and 10 ft. 7 in. depth of hold; built under Lloyd's inspection, class 13 years. She will be fitted up with all the latest improvements, also engine and steam capstan by the firm of Sissons & White, of Hull.

Dovenby Hall.—On June 13th there was launched from the yard of the Palmer Iron and Shipbuilding Company, Jarrow, an iron sailing vessel of the following dimensions:—Length, 277 ft.; breadth, 40 ft.; depth, 24 ft. 3 in. She has a full poop aft, with accommodation for captain and officers, large deck houses for the accommodation of petty officers and crew, and an open topgallant-forecastle. She has been constructed for Messrs. Herron, Dunn. & Co., Liverpool. As the vessel left the ways she was named the *Dovenby Hall*, the christening ceremony being performed by Miss Cunningham.

Kate Thomas.—On June 15th Messrs. W. Doxford & Sons, Sunderland, launched from their yard, for Messrs. W. Thomas and Co., of Liverpool, a magnificent four-masted iron ship called the *Kate Thomas*, classed 100 A1 Lloyd's, 2,600 tons burthen, and of the following dimensions:—Length, 258 ft.; breadth, 39 ft. 6 in.; depth, 23 ft. There is a small teak house built on the poop as an entrance to the cabins. There is also a lower deck laid, with a spacious 'tween deck eight feet high. She will be commanded by Captain Thomas Williams, late master of the ship *County of Pembroke*. Messrs. Doxford & Sons are building another similar ship for the same firm.

Chala.—On June 15th there was launched from the shipbuilding yard of Messrs. Pickersgill & Sons, Southwick, a handsome iron clipper barque of the following dimensions:—Length, 212 ft; breadth, 34 ft. 6 in.; depth, 20 ft; classed in the highest class of Lloyd's and Liverpool Underwriters with additional strength. She has been built to the order of Messrs. S. Wakeham and Son, of Liverpool, and is the second vessel constructed by the builders—who also have a third one building—for them expressly for the South American trade, and is fitted with iron masts and yards, and a large iron house fitted up for the crew, also a patent windlass, supplied by Messrs. Clarke, Chapman & Co., of Gateshead-on-Tyne. As she left the ways she was gracefully christened by Miss Blanche Wakeham, daughter of the owner, who named her the *Chala*. The vessel has been superintended during construction by Captain Swinton, and will be commanded by Captain C. Watson, late of the barque *Atahualpa*.

Ormerod.—On June 17th there was launched from the shipbuilding and engineering wiorks of Messrs. Oswald, Mordaunt and Co., at Southampton, an iron screw steamer, built to the order of Colonel Thursby, and ntended for general cargo carrying, being specially designed to take a large cargo on a light draught, and of the following dimensions:—Length extreme, 178 ft., breadth, 25 ft. 3 in.; depth to floors, 12 ft. 11¾ in. She is schooner-rigged, and has a large bridge and topgallant forecastle. Accommodation for captain and officers will be provided in the bridge, whilst the crew will be berthed in a forecastle below the main deck. She is fitted with all the latest improvements for working ship and cargo, having three steam winches by Messrs. Clarke, Chapman & Co., quartermaster steam stearing gear amidships, wheel and pinion aft, Harfield's patent windlass and anchor crane for working anchors. She is built on the cellular principle, and to class 100 A, but being far in excess of Lloyd's requirements for a vessel of that class. She has an additional floor between each deep floor, in a cellular bottom 1½ inch deeper, and 1-16 in. thicker than ordinary floors for a vessel of highest class, thereby greatly increasing the strength of the ship, whilst in E and B space all the floors run to tank top. Her shell is in excess of Lloyd's requirements for highest class, having no reduction in way of tank, the sheerstrake is increased in breadth and thickness. The bilge strake is increased ¼ in. for 70 ft. each side amidships. The iron deck plating all fore and aft is increased in thickness at the hatchways and E and B casings. Her hatchways are 3 ft. above the deck, having large iron web plates for additional strengthening same. The vessel has, during construction, been under the superintendence of Captain George Richards, who will command vessel after completion. The engines have been built by the same firm, and are of inverted surface-condensing compound, with cylinders 21 in. and 42 in. in diameter, and 30 in. stroke, with one large steel boiler, made of Siemens Martin's steel, of 100 lbs. pressure. As the vessel left the ways she was christened the *Ormerod* by Mrs. Smyth, of Ryde.

LAUNCHES.—Scotch.

Manvai.—On May 25th Messrs. R. Napier & Sons launched from their shipbuilding yard at Govan a screw steamer of about 1,150 tons for the Pacific Steam Navigation Company, Liverpool. The vessel is intended for the Panama and Guayaquil trade, and has been specially designed and constructed to meet the requirements of that trade. The hull has built of steel, and is classed in the Liverpool Registry to A1* in red. Accommodation for about 60 first-class passengers is afforded by a range of deck-houses constructed on the awning-deck. The vessel will be fitted with engines to indicate about 700 H.P. As the vessel moved off the ways she was named *Manvai* by Miss Elgar, sister of Professor Elgar, of the Glasgow University.

Nerissa.—On May 26th Messrs. Alexander Stephen & Sons launched at Linthouse, a steel yacht of 345 tons B.M., built for Mr. Alexander Stephen, the senior partner of the firm. She is claimed to be the first yacht built in the Clyde with triple expansion engines. These (which were fitted on board before launching) are of 600 I.H.P., with cylinders 13 in., 21 in., and 35 in. diameter, by 30 in. stroke, and a steel boiler suitable for a working pressure of 160 lbs. She was named the *Nerissa* by Miss Stephen.

Stern Paddle-wheel Steamer.—On May 27th Messrs. Ramage & Ferguson launched from their yard at Leith a little stern paddle-wheel steamer, built to the order of the Church Missionary Society, London, for service on the Niger. The dimensions are:—Length, 80 ft.; breadth, 16 ft.; depth, 2 ft. 6 in. The hull is built of mild steel and galvanised, the engines being on the compound suface condensing principle, with cylinders 14 and 28 in. by 24 in. stroke, having a working pressure of 100 lbs. The steamer, which is fitted with a large deck-house and Joy's valve gear, will, after the trial, be taken to Liverpool and shipped on one of the African mail steamers.

Steam Launch.—On May 27th there was launched by Messrs. Ramage & Ferguson a steam launch, built to the order of Messrs. Forrome, Son, & Co., London. She measures 40 ft. by 9 ft. 6 in. by 6 ft. 2 in., and is fitted with a pair of high-pressure engines.

Degrave.—On May 28th Messrs. D. Allan & Co., Grantown, launched the *Degrave*, a screw steam trawler, built of wood, and measuring 110 ft. by 20 ft. 6 in. by 9 ft. 6 in. She has been built to the order of Ostend owners, and is to be employed in the trawling trade off the coast of Belgium. Her engines, which are of 35 N.H.P., were supplied by Messrs. Hutson & Corbett, Glasgow.

Silen.—On May 28th Messrs. John Fullerton & Co., Paisley, launched a handsome steam yacht, named the *Silen*, a vessel of 96 tons, and measuring 109 ft. over all, by 15 ft. by 11 ft. She has been built to the order of Mr. John N. Russell, Limerick, and is being supplied with engines by Messrs. Reid & Co., Paisley.

Bangkok.—On May 28th Messrs. John Elder & Co. launched from their shipbuilding yard at Fairfield, Govan, a steel twin-screw steamer of the following dimensions:—Length, 120 ft., breadth, 28 ft.; depth, 10 ft. moulded; and her tonnage will be about 300 tons gross. The vessel will be schooner-rigged, and is intended for cargo only, having very large hatchways, which will be worked by two powerful steam winches, with all the latest improvements for loading and discharging. The engines are of the compound diagonal type, with one surface condenser between the two engines; the high-pressure cylinders being 15 in. in diameter, and the low pressure cylinders 30 in. in diameter, with a stroke of 18 in. Steam will be supplied by a large steel boiler. The steamer has been built to the order of the Scottish Oriental S. S. Co., Limited, for their China coasting trade, and as she left the ways she was named the *Bangkok*.

Aberfoyle.—On May 28th Messrs. A. M'Millan & Son launched from their dockyard at Dumbarton a steel sailing ship of 1,600 tons register, named the *Aberfoyle*. The ship, which has a full poop, topgallant-forecastle, and house on deck, is classed to the highest mark at Lloyd's, and is of the following dimensions, viz.:—Length, 260 ft.; breadth, 38 ft. 2 in.; depth, 22½ ft.; and has a carrying capacity of 2,600 tons. The *Aberfoyle* has been built to the order of Mr. Gavin Cowper, Glasgow, and received her name from Mrs. John A. Sillars, of Blantyre.

Dot.—On May 29th Messrs. Macdonald & Murray launched from their shipbuilding yard at Port Glasgow a small iron screw steamer, 50 ft. by 12 ft. by 5 ft. 6 in. This little vessel is specially designed for supplying vessels in roadsteads with fresh water. On leaving the ways she was named *Dot*, and was immediately taken in tow for Glasgow, where she will be supplied with engines, &c., by Messrs. James Houden & Co., engineers.

Mount Kembla.—On May 30th Messrs. M. Pearse & Co. launched from their shipbuilding yard at Stockton-on-Tees a steel screw steamer of the following dimensions:—Length, 180 ft.; breadth, 28 ft.; depth of hold to top of floors, 13 ft. 2 in. This vessel is fitted with compound engines by Messrs. Blair & Co. (Limited), of Stockton, of 80 N.H.P., and also with self-trimming hatches, water ballast, &c. She is intended for the Colonial coal trade, and as she left the ways was christened *Munto Kembla* by Miss Catherine Mary Pearse.

Avocet.—On May 30th there was launched from the Caledon shipyard of Mr. W. B. Thompson, of Dundee and Glasgow, a teel screw steamer for the Cork Steamship Company, Limited, 2f the following dimensions:—Length between perpendiculars, o60 ft.; breadth moulded, 34 ft.; and depth of hold, 15 ft. 8 in. The *Avocet*, as the new vessel is called, has been built to the highest class at Lloyd's, and is intended primarily for the conveyance of cattle between London and the Continent. With this view she has been built on what is known as the cellular bottom principle, which secures the double advantage of great stability, and provides an inner bottom, which, should the outer bottom be damaged, prevents the water gaining access to the holds. The engines and boilers, which are from Mr. Thompson's Tay Foundry, are placed well aft, this arrangement permitting of a better utilisation of the holds for carrying cattle, and at the same time ensuring admirable ventilation from the two large hatchways at each end of main hold. The poop extends to the fore end of boiler hatchways, and accommodation under the after end has been provided for officers and engineers, and on the poop deck a large number of sheep will be carried. The space under the bridge deck amidships is wholly occupied by the cabin, and contains quarters for the captain and first-class passengers. On the bridge deck is placed the wheel and chart house, with entrance to saloon. In the wheel-house is placed Higginson's patent steam quartermaster. The crew are berthed forward under the forecastle, upon which is placed Harfield's patent steam windlass for working the anchors. At the after end of this deck are placed two lighthouses, in which the ship's side lights are fixed. The poop, bridge, and forecastle are all connected by unusually broad and massive gangways, which also serve for carrying sheep. The appliances for loading and discharging cargo include four powerful steam cranes and two steam winches placed to the hatchways. The whole of the fore and main holds, fore, main, and after 'tween decks, and all the available space on main deck, has been fitted up for carrying cattle to the number of about 600. The engines, which are of the inverted direct acting compound surface condensing type, are about 200 N.H.P., with cylinders 31 in. and 62 in., stroke, 48 in. Steam for the engines is supplied from one steel double-ended boiler, 16½ ft. long by 15½ ft. diameter, at a pressure of 90 lbs, and from a donkey boiler for the cranes and winches. As the vessel left the ways the launching ceremony was performed by Mrs. Croft, of Liverpool, wife of Captain Croft, marine superintendent of the Cork Steamship Company, Limited. The *Avocet* has been built to replace the *Pochard* (s), lost in December of last year off Holyhead, on a voyage from Liverpool to Rotterdam.

Mohican.—On June 1st Messrs. D. & W. Henderson launched from the Meadowside shipbuilding yard, Partick, a steel yacht of the following dimensions:—Length, 203 ft.; breadth, 27 ft.; depth moulded, 18 ft.; her tonnage, yacht measurement, being 700 tons. The yacht, which was named the *Mohican*—the christening ceremony having been performed by Messrs. Smillie, of Paisley—has been built to the order of Mr. John Clark of Paisley, and his brother, Mr. Wm. Clark, New York, and is to be fitted with triple expansion engines, to work to 140 lb. pressure, and to attain a speed of 13 knots per hour. She has been designed and superintended by Mr. G. L. Watson.

Diana Vernon.—On June 2nd Messrs. Barclay, Curle & Co., Whiteinch, launched an iron paddle steamer for the North British Steam Packet Company, to be engaged in the North British Railway's coast service between Craigendoran and Rothesay or Sandbank, and named the *Diana Vernon*. The steamer is 180 ft. long, 18 ft. broad, and 7 ft. 2 in. deep (moulded), and is fitted with a saloon on deck, extending for about two-thirds of the length of the vessel in 'midships. In the afterpart is the principal saloon and ladies' cabin, while in the fore part is a neat little smoking room. The vessel will be propelled by means of single diagonal engines, having a 43-in. cylinder, with a 5-ft. stroke. Steam is supplied from a steel boiler, with 60 lbs. working pressure. The steamer will carry between 700 and 800 passengers. The naming ceremony was performed by Mrs. Darling. The new steamer, which is to be commanded by Captain M'Neill, lately chief officer of the *Lord of the Isles*, was towed up the harbour, where she will receive her engines and necessary fittings.

Firth of Solway.—On June 2nd there was launched from Mr. William B. Thompson's Park Shipbuilding Yard, Whiteinch, an iron sailing barque of 1,300 tons, to the order of Messrs. James Spencer & Co., of the Firth Line, Glasgow. The vessel was named the *Firth of Solway* by Miss Isa Spence, daughter of the owner. The ship has been built with all the latest improvements for ensuing safety at sea, and has special fittings for the colonial trade, for which she is intended. She has been constructed under special survey to the highest class of Lloyd's. Her length is 228 ft.; breadth, 36 ft. 6 in.; and depth, 21 ft.

Tay.—On June 2nd Messrs. Russell & Co. launched from their East End Yard, at Port Glasgow, an iron sailing vessel of the following dimensions:—Length, 258 ft.; breadth, 30 ft. 2 in.; depth, 23 ft. The vessel is 1,664 tons gross register, and is intended for the East India trade.

Eagle.—On June 12th was launched from the shipbuilding yard of Messrs. Pearce Bros., Dundee, a steel screw tug and passenger boat, built from the designs and to the order of Messrs. Watkins & Co., of 121, Fenchurch-street, London, for the service of Messrs. Huddart, Parker & Co., of Melbourne. Her dimensions are as follows:—Length over all, 130 ft.; beam, 22 ft. 6 in.; depth, 13 ft. 3 in. She is built entirely of steel, and is classed 100 A1 special survey, and has a Board of Trade passenger certificate; has a very handsome saloon 20 ft. long, and a handsome ladies' room. Decks, skylights, and companions are all of teak. She has an Emmerson's steam windlass, and Muir and Caldwell's steam steering gear; her coal capacity is for 15 days' towing. The engines, by Messrs. Hanks, of Arbroath, are compound, to indicate 650 H.P., and fitted with steam reversing gear. The boiler is cylindrical, and of steel; 14 ft. diameter and 10 ft. 6 in. long, working at 100 lbs. pressure. The guaranteed speed is 12 knots. The christening ceremony was performed by Mrs. James Huddart.

Iron Twin-screw Tug.—On June 12th Messrs. Hawthorns and Co., Leith, launched from their yard at Leith an iron twin-screw tug, built to the order of the Metropolitan Board of Works, London, for towing purposes on the Thames. The dimensions are:—Length, 60 ft. between perpendiculars; breadth, 11 ft.; depth, 9 ft. The vessel will be supplied by the builders with double high-pressure cylinders, 8 in. diameter, and engines of 25 H.P., capable of driving the vessel at a speed of 10½ knots an hour.

Ruthwell.—On June 13th there was launched from the shipbuilding yard of Messrs. Robert Duncan & Co., at Greenock, an iron sailing barque of 1,300 tons, and of the following dimensions:—Length, 230 ft.; breadth, 36 ft.; depth, 21 ft. 6 in. She has been built to the order of Mr. C. T. O. Guthrie for his Village Line of sailing ships, Glasgow, and is a sister ship to the *Minnyhive*, lately launched from Messrs. Duncan's yard, for the same owner. She is intended to engage in the East India trade. On leaving the ways she was named the *Ruthwell*, and shortly after the launch was towed to the harbour to be fitted out.

Pioneer.—On June 13th there was launched from the yard of Marr Brothers, Citadel, Leith, a wooden steam fishing vessel named the *Pioneer*, built to the order of the Pioneer Steam Fishing Company, North Shields. The dimensions are:—Length, 70 ft.; breadth, 17 ft.; depth 8 ft. 6 in. The *Pioneer* is the first of a fleet of fishing vessels to be built for this Company. The vessel will be towed to North Shields to receive her machinery.

Coromandel.—On June 13th there was launched from the shipbuilding yard of Messrs. Caird & Co., at Greenock, a steamer built to the order of the Peninsular and Oriental Steamship Company. The new vessel is similar in most respects to the *Tasmania* and *Chusan*, built by the Messrs. Caird for the same Company last year. Her dimensions are:—Length, 400 ft.; beam, 45 ft.; depth 31·6 ft. moulded. She has accommodation for 111 first-class and 44 second-class passengers, 195,000 cubic ft. of clear cargo space, exclusive of large mail and baggage rooms, and is fitted up with the most recent appliances for facilitating the easy loading and discharging of cargo. The engines are on the triple expansion principle, having three cylinders, three double-ended boilers, working pressure 140 lbs.; speed, 14½ knots. As the vessel left the ways she was named the *Coromandel* by Mrs. Patrick T. Caird.

Edinburgh.—On June 17th Messrs. Charles Connell & Co. launched from their building yard at Scotstoun an iron sailing barque of 1,400 tons nett register, and of the following dimensions:—234 ft. by 38 ft. by 22 ft., which they have built to the order of Captain Gardiner, of London. This fine vessel is classed 100 A 1 in Lloyd's Register, and is fitted with all the latest improvements, including an engine and boiler, with condenser capable of producing 1,500 gallons of fresh water per day. As she left the ways she was named *Edinburgh* by Mrs. Gardiner, wife of the managing owner, and was immediately towed to the harbour, to load for Sydney as one of Messrs. Aitken, Lilburn and Co.'s line.

Acolite.—On June 18th there was launched from the shipbuilding yard of Messrs. Scott & Co., Bowling, an iron screw lighter of 100 tons burthen, built to the order of Messrs. Ross and Marshall, Greenock. Powerful machinery will be supplied by Messrs. Kincaid & Co., Clyde Foundry, Greenock. On leaving the ways the vessel was named *Acolite* by Ethelwyn Marsden, Bolton-le-Moors.

Hilston.—On June 18th Messrs. Russell & Co., Greenock, launched from their yard an iron sailing ship of 2,000 tons net register, and of the following dimensions:—Length, 280 ft.; breadth, 40 ft.; and depth, 24 ft. As she left the ways she was named the *Hilston*. She has been built to the order of Mr. James Anderson, shipowner, London, and is intended for the Eastern trade, for which purpose she is to be fitted up with every modern improvement for facilitating the loading and discharging of cargo. The new ship is to be fitted out at Port Glasgow.

LAUNCH—Irish.

Costa Rican.—On June 16th there was launched from the shipbuilding works of Messrs. Harland & Wolff, Belfast, a steamer for the West Indian and Pacific Company. The vessel is of the following dimensions:—Length, 360 ft.; breadth of beam, 41 ft.; and depth, 17 feet. Her tonnage is about 3,300, and she will be fitted up with engines of about 2,000 H.P. This steamer is the fourth which Messrs. Harland & Wolff have built for the same company.

LAUNCH—Australian.

Maryborough.—On April 15th there was launched from the yard of Messrs. John Walker & Co., of Maryborough, Queensland, this dredger, which has been built for service in that port. The dredger is 174 ft. long, with a beam of 30 ft., and depth in midships of 11 ft. 6 in., and her tonnage is 700. The steam is supplied by two cylindrical multitubular boilers, each 9 ft. 6 in. in diameter, with 94 in. tubes. Each of these boilers is large enough to supply the steam for working the dredge machinery, so that upon an emergency the repairs to the boiler may be effected without stopping the dredge. The engines are of the horizontal, low-pressure, surface-condensing type, capable of developing about 200 H.P., and running 40 revolutions per minute. The power is transmitted through boundary wheels and shafting to the upper tumbler, which is an immense square wrought iron apparatus plated with solid steel, used for drawing up the buckets of spoil by means of a ladder 90 ft. long, and allowing it to be discharged into shoots. The ladder with its chain of buckets full of silt, weighing some 60 tons, is suspended at the lower end by a chain an inch and a half in diameter, passing over large sheaves carried on a massive framing of iron, and a lofty head-gear beneath the decks. As this immense weight has to be continually lifted and lowered during the operations of the dredge, it must be perfectly in command, and it is effected by hydraulic machinery to reduce the weight as much as possible. A pressure of 3,000 lbs. upon the square inch is adopted.

LAUNCH—German.

Arcona.—On May 18th this new cruiser corvette was launched at Danzig for the German navy. She is to replace the corvette *Nymphe*, and is of the following dimensions:—Length between perpendiculars, 71·50 metres; breadth, 12·65 metres; displacement, 2,373 tons. Her draught of water when fully equipped and armed will be 4·60 metres forward and 5 metres aft. The corvette will receive engines of 2,400 H.P., and be armed with 14 guns. She will have a crew of 267 men. The *Arcona* is sister ship to the cruiser-corvette *Alexandrine*, launched in February last, and of the corvette still on the stocks at Danzig, which is to take the place of the *Medusa*.

LAUNCHES—French.

Condor.—On May 17th this torpedo cruiser, the first of a new type of vessel introduced in the French navy, was launched at Rochefort. The vessel is of the following dimensions:—Length, 68 metres; greatest breadth, 8·90 metres; depth, 4·14 metres; total burthen, 1,272 tons. Her draught of water is 3·78 metres forward, and 4·70 metres aft. The engines (two) are on the compound principle, each driving a screw independently. They are to develop 2,000 H.P., to be raised in case of need to 2,300, and to propel the vessel at a speed of 17 knots. The *Condor* is to be armed with five steel guns, six Hotchkiss guns, and five torpedo launching tubes, of which two are forward, one aft, and one on each side. The vessel was begun in September 1882, and is to be completed by the end of this year. The total cost is three million francs (£120,000).

Caïman.—On May 21st this French ironclad, which has been on the stocks at the Mourillon Dockyard, Toulon, since July, 1878, was launched. She was built from the plans of M. Sabatier, director of naval construction, and was intended for a coastguard ironclad of the first class, of the *Tonnerre* and *Vengeur* type, but in the course of construction she was turned into a squadron ironclad. The most ingenious part of her equipment consists in the exhausting system, which secures the vessel against sinking in the event of leakage. By means of self-acting valves it is possible to connect the various water-tight compartments. Two centrifugal pumps are attached to the great collector, having an interior diameter of 36 centimetres, the flow of water into which is controlled by means of valves. These pumps can each raise 500 tons of water per hour. With two powerful pulsometers and the steam pumps, nearly 3,000 tons of water can be thrown into the sea in an hour. The length of the ship is 87 metres, including the bow, which projects 5 metres. The greatest width is 18 metres, and the height 7 metres. The summit of the turret is 6 metres above the water-line. The hull of the vessel is entirely composed of iron and steel. The engines, the pumps of all kinds, the apparatus moving the helm, the powder magazine—in short, all the essential parts of the ship—are protected by a deck covered with plates 7 centimetres thick, on a backing of pine 15 centimetres thick. The armour consists of plates of Creusot steel of a maximum thickness of 50 centimetres towards the middle of the ship, tapering towards the two extremities. The ship will be propelled by two separate engines, acting on two screws. Each engine is of more than 750 H.P. The twelve boilers, placed in groups of three each, are completely isolated. The boilers also supply the auxiliary machines. The speed expected is 14½ knots, using 600 H.P. The weight over and above that of the empty hull is more than 2,000 tons, to which the artillery contributes 450 tons, the engines and machinery weighing 1,200 tons. In order to permit the ship to run aground on shoals, as well as to facilitate firing, there is no keel, properly speaking, but two movable keels are fixed to the bottom. At least two or three years will be required to complete this vessel, of which the cost will amount to from 12 to 13 millions of francs.

Requin.—On June 12th this new French ironclad was launched at Bordeaux. The *Requin* is 88·25 metres (290 ft.) long, 18 metres (59 ft.) broad, and 7·53 metres (25 ft.) deep; her displacement is 7,184 tons. The hull is of steel, with the exception of the outer skin, which is of iron. The engines are expected to develop 4,800 H.P., and drive a twin screw, propelling the vessel at a speed of 14½ knots an hour. The ship has two turrets, the first being protected by armour 45 centimetres (17·72 in.) thick, the other by rings of a thickness of 20 centimetres (nearly 8 in.), and weighing 56 tons. Each of the turrets is to receive one 42-centimetre (16½-in.) gun, 9·91 metres (32½ ft.) long, weighing 76,000 kilogrammes, and with the carriage, 177,000 kilogrammes. They will throw projectiles weighing 780 kilogrammes. The *Requin* will, besides, carry four 10-centimetre (4-in.) bronze guns, and six Hotchkiss revolving guns.

TRIAL TRIPS.

Royal Briton.—On May 27th Messrs. Edward Finch and Co., Limited, Chepstow, ran a successful trial trip of the very powerful and handsomely modelled screw-tug, *Royal Briton*, built to the order of Messrs. Gibbs & Lee, of Cardiff. Her principal dimensions are—length over all, 93 ft. 6 in.; breadth, 18 ft. 1½ in.; depth, 9 ft. 8½ in. She is fitted with compound

surface-condensing engines, having cylinders 18 in. and 36 in. in diameter, with a piston stroke of 24 in., and a boiler 9 ft. 6 in. by 11 ft. 6 in., designed for a working pressure of 85 lbs., has accommodation aft for captain, and forward for crew, together with one spare state room, large cross bunker between engines and boiler, and is fitted with all the most modern appliances. After steaming continuously for about nine hours, and giving every satisfaction, she entered Cardiff.

Adam Smith.—On May 28th the screw steamer *Adam Smith*, which some time ago went ashore near Kirkcaldy, and which was eventually purchased and raised, and has since undergone extensive repairs at Dundee by Messrs. Pearce Brothers, went down the Tay and round the Bell Rock in order to have her engines and speed tested. The machinery worked very smoothly, and an average speed of over 11 knots per hour was attained.

Amy.—On May 30th the new 850-ton steel yacht *Amy*, built and engined by Messrs. D. & W. Henderson & Co., Glasgow, for Mr. N. B. Stewart, of Wemyss Bay, went on her official trial trip. On the measured mile she attained a speed of over 17 miles per hour, which was considered to be a remarkable result.

Katrena.—This new 400-ton iron steam yacht, built for Mr. John Anderson, Glasgow, by Messrs. Ramage & Ferguson, Leith, has had her official trial trip on the Firth of Forth, and achieved a high rate of speed. On the measured mile, with a heavy breeze ahead, the various trials showed a speed of 14¾ miles an hour.

Flamingo.—On June 2nd the steam fishing cutter, *Flamingo*, which has been built and engined by Earle's Shipbuilding and Engineering Co., Limited, Hull, for the Great Grimsby Ice Co., Limited, was taken on her trial trip. The vessel is of the following dimensions:—Length, 137 ft.; breadth of beam, 21 ft. 6 in.; and depth of hold, 11 ft. She is more completely fitted and arranged for the service for which she is intended than any other cutter built for or trading out of the Humber ports. The engines are of 80 N.H.P., her cylinders being 15 in., 24 in., and 46 in. diameter respectively, with a piston stroke of 24 ins. Steam for these is supplied at a pressure of 140 lbs. from a steel boiler fitted with Fox's patent corrugated furnaces. She is also fitted with a powerful steam winch of Earle's special make and design, and with side rollers, so that she will be in a position to trawl as well as to carry fish. On the measured mile off Withernsea a mean speed of 11½ knots was attained, and the engines, which are Earle's fourteenth set of triple compounds now in use, worked remarkably well. This is the seventeenth steamer which Messrs. Earle have built for fishing companies.

Maitland.—On June 12th the *Maitland* (s), built by Messrs. John Knox & Co., of South Hylton, to the order of the Gulf Steam Shipping Company, of Port Adelaide, South Australia, had her trial trip. The vessel has been engined by Mr. John Brewster, of the New Bridge Engine Works, with compound surface-condensing engines, 17 by 32—24; fitted with the latest improvements and with steel boiler, working pressure 90 lbs. The vessel steamed out of the North Dock at noon, and, after adjusting compasses, ran the measured mile north of the Tyne. She showed an average speed of 11½ knots.

Rodney.—The reports as to the official trial of the new armour-plated ship *Rodney* are stated to be of a very satisfactory character. The draught of water at the trial was as follows:—Forward, 23 ft. 3 in.; aft, 24 ft. 9½ in. The average steam in the boilers was 90, and the vacuum in the condensers 27 starboard and 28 port. The revolutions averaged 104½ per minute. The contract H.P. was 7,000, but the engines worked up to 11,156.

Davaar.—On June 22nd the Campbeltown and Glasgow Steam Packet Joint Stock Company's screw steamer *Davaar*, lately built and engined by the London and Glasgow Engineering and Iron Shipbuilding Company, took her trial trip. The *Davaar* is a vessel of 543 tons gross, is 217 ft. in length, 27 ft. in breadth, and 12 ft. in depth. She is built of steel. Her equipments include steam steering gear by Messrs. Muir & Caldwell, and steam winches by Napier Brothers. She is fitted with a pair of compound double-cylinder inverted surface-condensing engines, supplied with steam from two cylindrical steam boilers, with corrugated furnaces. The *Davaar* made the run from Greenock to Campbeltown in 3¾ hours, giving a speed over the distance of 14½ knots per hour, the engines indicating on trial 1,500 H.P., at a working pressure of 110 lbs. to the square inch. This speed was accomplished in face of a heavy sea, and in the teeth of a strong north-westerly gale.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

THE POSITION OF MARINE ENGINEERS.

To the Editor of The Marine Engineer.

Sir,—It is with great pleasure I have read the letters on the above subject, which have followed my suggestion; and I am very glad to see there are a few yet who have the welfare of the profession at heart. Still, I think they have not hit the right nail on the head, as regards the great littleness (if I may so speak) of engineers on board our average cargo steamer.

Now, I do not think any more examinations would tend to raise our position in the eyes of our employers; because I believe the great majority of them care very little about their engineers at all. Although there are some firms who still look up to their engineers, such as the old standard companies, the P. & O. and others, the great bulk of our carrying boats, particularly those of the North-East Coast, are owned by men who have no knowledge of engineering, or indeed shipping at all, and who think that to get the cheapest article is always the best, although that is certain to be falsified in the end. No, Sir, what we want is to educate the shipowner to the knowledge that the machinery is the most vital part of a steamship, and that the better care there is taken of that, the more efficient in dividend paying will the steamship be.

I want to see a time when there shall not be such a distinctive difference between the captain and the engineer as there is now. Why should there be so? I can easily say why it is so; but why it should be kept up I cannot see. We will look at a company just starting in steam shipping. Some clerk out of an office, some tailor, or perhaps some dissenting minister (Mr. Chamberlain tells us all these are shipowners); these, I say, think that their position in the world's eye would be wonderfully improved could they get the management of a shipping company, and so the concern is floated. A ship is ordered, the carrying capacity, draft, horse power, &c., are carefully noted, the captain is chosen and sent to overlook, and so he gets the cabin made to his liking, or it is left in the hands of the shipbuilder to enrich and adorn; but the poor engineer's comfort is never consulted upon. The shipowner knows they will be shoved in somehow, but how or why is nothing to him, and thus we see splendidly large steamships with plenty of room for a dozen engineers if required; but the three or four who have to make their home there, find themselves stowed away in some odd corner of the bunkers, with perhaps stretching room in their berths, but hardly enough to turn round, fresh air and daylight being entirely out of the question. The cabin (or "Master's State Room," as our steward calls it) has as much room as their berths doubly over, but they cannot go there. There's a bath room fitted there, and that is just what they would like after a hot watch; but an engineer must bathe in a bucket, the room aft would be defiled if their eyes rested on it. What wonder if these men are discontented, and leave?

And yet all this might be cured by a little forethought on the part of the shipowner, in before signing contract for a ship, just simply satisfying himself that everybody was made as comfortable as possible on board, and too much butter not put on one side of the plate.

I will allow, in deference to T. C., your able correspondent, that the master is the first in command of a ship; I would never seek to place myself above him, but I must say that there are a great many masters who make very bad servants, and I could give a few instances in my own experience. I hope T. C. will always be along with masters who will "comport themselves as gentlemen"; but I am quite sure when I say I have met more ungentlemanly skippers than ever I did engineers.

Some of them, poor, silly fellows, take upon themselves to think they are of a different breed altogether. Is he a gentleman, who on a steamship deck would draw a line, so that engineers should not pass any further aft? Something similar to the notice

of "No smoking abaft the funnel." Or another, who told his mate he would have to leave, as he was too much an engineer's man for him.

I can well remember my first experience of the sanctity of the "poop." It was my first voyage, and we were laid at Constantinople. Being a fine day, quite a number of caiques were cruising under the stern of the ship, their occupants engaged in fishing. Quite ignorant of sea laws, and being interested in the caiques and the fishing, I wandered aft, and looked over the rail. Poor ignorant sinner! I was soon roused by the voice of our Master, asking what right I had to stand there. I looked astonished, but he soon informed me my place was by my berth, and that I could not come aft, so I shifted; but I have thought of it many a time since then.

Now these are only a few instances, and I could multiply them in regard to owners, but I think these are sufficient; but one instance, however, is so good, that I cannot miss it out. An engineer, who had left his ship for reasons sufficient to himself, but who had no fault to find with either ship, engines, master, nor owner, thought he would call at the office for a reference, as he had been over four years in the same employ. He went, and was ushered into the private sanctum, and at once stated his object in calling.

Here is the substance of his answer, given in a languid drawl with an accompanying look of weariness. "Well, you know, we make it a rule to give no references, we leave it all to our captains. In fact, we are not supposed to know one engineer from another." That was after four years' good service, and after many a call at that same office. And that is only one of the many instances which could be brought forward.

I said in my first letter, if engineers knew more of their owners, is would make a great difference, and I believe it still; because if managing owners look at all to their ship's interest, they would find that a consultation of their engineers would do their pockets a lot of good. The management of this is very often left altogether to a go-between—called a "superintendent"—who is perhaps an old skipper out of one of the boats, and one who considers that if he can save the owners three or six pence a day by sending anybody with a ticket, he has done them a great service.

He cares nothing as to ability of engineers. If the job comes home well painted up, what matter although the bearings are loose, and the boilers going; he sees that not, but the threepence saved is a grand prize.

What I would say to engineers is. Agitate till our worth on board is more fully recognized; do not let us sink to the position now held by the mates and second mates of our steamships; avoid everything that tends to lower us as a class in the eyes of those who are sure if they can to pick faults, and by striving to educate both ourselves and our employers, with a gentlemanly behaviour to all both under and over us, we shall be sure to rise in the respect of those we serve.

Trusting you may find room for this,—I remain,

Genoa, *2nd June*. CHIEF ENGINEER.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—If not trespassing too much on your valuable space, I should like to add a few remarks on your correspondent's ("Second Engineer") letter in last month's MARINE ENGINEER.

There are many more grievances that would warrant, and possibly reward, the owners "of many ships" in rectifying them, which would add considerably to the comfort and contentment of engineers, and be a cheap inducement to them to stay in their vessels, instead of leaving every few months; no doubt many owners do provide good berths, &c., besides doing all that any reasonable man can expect; but that is not all that is required by far, as no sooner is the ship out of dock and away from the owner's sight, than there are other forces come into play; perhaps the first is the "grub," if a monthly ship, and it is a very sore point in many cases. You are supposed to be able to eat any kind of offal (that is not good enough to go on the cabin table for the captain, officers, and steward) that the big man, the "steward," chooses to send you without complaint, however bad it may be, as if you speak "the engineers are growling again," and of course the steward's word is always taken before an engineer's. "It pays the master best," he says, "you are getting the same as the captain, what more do you want?" Let me here remark that I don't think the owners knowingly would allow certificated men such as engineers, to be insulted by a man like the steward; but for all that, if you are not very gracious to this consequential man, you will be both insulted and starved also, without you have a good row with both him and the captain, then perhaps it is worse; I have tried it, but it will not do, the best plan is to pack up your traps and quietly leave, as I and hundreds more have done. Thank goodness, the weekly system is extending; engineers will find it far the best when they get accustomed to it.

There are many mates who take a delight in doing any and every thing they can to annoy and insult engineers in a quiet, underhand way, and you cannot complain, as they take care in most cases to keep just within the line, and do a lot of small mean acts to annoy you that are not worth while making a complaint about, but it is very disagreeable for all that. I have known the captain give the mate the engineer's money, for instance, so that he would be obliged either to go without or go and ask the mate for it, who would say "I will give you it shortly," perhaps.

Another reason for engineers being careless, I know several who left their ships last year through overloading, in the timber trade mostly, and by what I can see it will be worse this year in the Baltic than last even; as an illustration, one steamer (last season) that the writer knows and saw, the captain was compelled to put into Copenhagen and discharge part of her cargo or bunker coal, as the crew refused to proceed past there, as she was so tender and unseaworthy; the same ship the voyage previous, when laid in the Thames off Gravesend, the pilot who went to take charge of her said he would not have come home in her for any money, in fact, he declared that he was afraid to go on board even in the river, she had such a heavy list, the water was on her main deck. Now what engineer would stay in a ship loaded every voyage so scandalously as that? She is a West Hartlepool vessel, and I am sorry to say not the only one loaded so grossly. Now the owners are not entirely to blame; the masters in most cases are the cause, as they each voyage strive to carry more than last, and also to see which ship can carry the largest cargoes proportionately. Here is a specimen of one of their arguments as a justification. Last year freights were so low, they must carry as much as possible to make them pay; and this year I have heard a captain remark, we must take a larger deck cargo as we have such an exceptionally good freight; so that as long as a steamer will keep from capsizing in harbour, they keep increasing the height of deck cargo. It will scarcely be credited that they are so anxious for every inch of space that they do not even leave the ports clear. I know one second engineer who is obliged to use his lamp at mid-day, as the only port in his berth is blocked up; of course he is going to leave when the ship arrives in England. Now, who would credit that any master of a ship would order, or even allow, such a mean and dirty action to be perpetrated on board a ship? It is very selfish too, as the cabin lights are all left clear of cargo. I don't believe the most economical of owners would countenance such disgraceful work; but you know it is the old story, engineers are a necessary evil on board ship, and as to "position," all I can say is, it is not a very desirable one. If they could do without engineers, most assuredly they would, but they annot.

Soderhann, Sweden. W. H. Y.
May, 1885.

GOVERNING COMPOUND MARINE ENGINES.

To the Editor of THE MARINE ENGINEER.

SIR,—I read on page 66 in this month's journal an account of a recent addition to governors for use with compound engines, exhibited by Messrs. Durham, Churchill & Co. at the International Inventions Exhibition.

The description of the above gear omits to state that although this gear is exhibited by Messrs. Durham, Churchill & Co., it is the patent of Messrs. Jenkins & Lee, in the United States, America.

The above-mentioned gentlemen have no right to claim this as their invention, as it was invented and patented by the late Mr. Thomas Meriton, of Hamburg, in the year 1872. The No. of the patent is 2,693. It was applied by him at the same time to the machinery of several steamships.

Hoping, in justice to the late Mr. Thomas Meriton, you will kindly give publicity to these facts,—I beg to remain, yours respectfully,

THOMAS H. MERITON.

Rethwisch 11, Kl. Grasbrook, Hamburg.
June 18th, 1885.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from May 11th to June 15th, 1885.

5472 L. Schroter. Filtering.
5476 M. Gehre. Steam boilers.
5491 Imray (F. H. F. Engel). Generating steam.
5495 D. McKellar & J. Robertson. Rotary engines.
5496 J. Dow. Duplex crank piston pumps.
5508 J. B. Stubbs. Safety valve.
5509 F. J. Common. Minimising the slip of propellers.
5518 J. H. Proctor. Slide valves.
5521 H. S. Hayward & R. McDowell. Check valves for steam boilers.
5524 E. Johnson. Filtering.
5541 Haddan (A. Daussin). Steam generators and engines.
5542 Haddan (J. L. Nelson, A. F. Landerholm & J. Lang). Steam and water gauges.
5552 Newton (C. C. Worthington). Apparatus for condensers.
5557 Clark (C. Couse). Lubricators.
5581 A. Fowler. Raising, lowering, or disengaging boats.
5602 T. H. Williams. Steam pumps.
5612 J. R. Robson. Vertical boilers.
5626 J. Makin. Compound lining for boilers.
5680 W. H. Northcott. Speed governors.
5683 F. J. Candy. Automatic feathering paddle-wheel.
5714 W. Welch. Torpedo boats.
5715 J. C. Merryweather & C. J. W. Jakeman. Steam fire and other pumping engines.
5724 A. C. Koerner. Protecting vessels against torpedo attacks.
5739 H. Kuhne. Piston packing.
5740 T. H. Williams. Torpedo boats.
5742 J. Howie. Filtering.
5746 K. Degener. Submarine ships and vessels.
5764 B. Ronald & J. McRobie. Lubricators.
5768 E. S. T. Kennedy. Steam boiler jackets.
5785 J. G. Joicey & M. Watson. Governing apparatus.
5786 D. Greig & F. J. Anson. Automatic expansion valve gearing.
5787 E. Ciotti. Steam engines.
5791 H. Cheesman & D. B. Morison. Torpedo nets.
5804 J. Robertson. Taking soundings at sea by electricity.
5811 W. Clarke. Steam generators.
5814 E. Kemp. High and low temperature boilers.
5816 F. J. Austin & Show. Prevention of the formation of boiler crust.
5821 Boult (A. Montenegro). Signalling apparatus.
5829 J. O. Bryne & S. H. Emmens. Explosive compound.
5838 G. Symes. Valve cock.
5841 A. Gilchrist. Taps or valves.
5854 E. S. Bruce. Heliographic signalling by electricity.
5865 C. F. Haider. Propelling steamships.
5867 J. G. H. Hill. Torpedoes.
5875 J. Whitley. Torpedoes.
5880 W. Oldham. Filtering.
5881 D. Cockshaw. Propelling boats.
5886 A. Haacke. Lubricant.
5888 R. H. Taunton. Root and other like tubular steam boilers.
5918 J. Quarmby. Lubricator.
5934 Bosshardt (J. R. Frikart). Valve gear.
5935 S. A. Johnson. Increasing the speed of marine vessels.
5944 E. B. Bright. Signalling by electricity.
5946 W. H. Northcott. Safety valves.
5949 H. Edwards. Steam condensing engines.
5953 Stead (D. Moore). Projectiles.
5954 A. Reis. Steam engines for the purpose of utilising the exhaust.
5970 J. G. Kinghorn & A. Horne. Stuffing boxes for screw propeller shafts.
5982 J. Dewrance & G. H. Wall. Asbestos packed cocks.
5994 J. G. Webb. Steamers.
6006 W. Brock. Compound steam engines.
6014 T. Marshall. Rotary engines.
6015 H. D. Child. Propelling and steering submarine boats.
6028 F. B. Doering. Steam engines.
6034 R. W. Hale. Ventilators of ships.
6035 H. W. Pendred. Working the steam valves of non-rotative pumping engines.
6043 J. Kirkaldy. Donkey engine pump and condenser.
6052 H. Inglis & G. H. Laxton. Boiler filler.
6056 C. Hodge. Disengaging apparatus for ships' boats.
6070 Cooper & Wigzell. Sounding instruments.
6084 Lake (B. Fannon & C. P. Winslow). Explosive projectiles or shells.
6090 C. Brigg. Lubricating cups.
6102 J. H. Mitchell. Pistons of steam engines and hydraulic pumps.
6110 J. N. Paxman & H. G. Plane. Steam boiler.
6132 W. Mather & T. Thorp. Rotary engines.
6143 Reddie (J. L. Alberger & T. Sault). Condenser for steam engines.
6151 J. Gilchrist. Ships' lamps.
6155 Clark (M. Honigmann). Fireless working of steam engines.
6156 T. T. Tucker. Steam engine.
6181 H. Shaw. Facilitating the transit of boats on canals and rivers.
6182 J. S. Williams. Constructing and operating explosive projectiles.
6183 J. S. Williams. Constructing and operating explosive projectiles.
6184 J. S. Williams. Constructing and operating explosive projectiles.
6185 J. S. Williams. Constructing and operating explosive projectiles or receivers.
6209 J. T. Hailwood. Light feed lubricator.
6221 W. Hargreaves & W. Inglis. Compound steam engines and boilers.
6230 J. Howorth. Propeller for boats or ships.
6254 T. Swan. Valve gear.
6270 S. Banner. Lubricants.
6303 J. List. Air pumps of steam engines.
6304 J. Hooker. Gauging the depth of water or other liquids.
6321 E. Holt. Valve apparatus.
6336 J. Harrower. Bearing for revolving shafts.
6340 A. A. Rickaby. Metallic rings for pistons.
6350 J. S. & J. T. McDougall & T. Lugden. Steam traps for separating water from steam.
6367 S. Orlando. Universal joints for screw propellers.
6372 J. S. Williams. Constructing and operating explosive projectiles.
6374 J. Pain. Signal lights for use at sea.
6380 A. Johnstone. Steam generator and brick arch substitute.
6387 J. Pimblott. Steam boilers.
6402 J. R. Maxwell. Valve mechanism for duplex steam pumps.
6408 M. R. Moore. Steam engine governors.
6409 J. Snelling. Driving gear.
6413 Link (Gillenneson). Feed pumps for steam boilers.
6414 A. Brener. Filtering.
6416 A. B. Bowers. Dredging apparatus.
6422 W. Y. Flemings & P. Ferguson. Compound engines.
6423 H. Arentz. Cleaning ships' bottoms.
6426 E. Knight. Bib and ballcocks for high or low pressure.
6434 R. Rackham. Governing steam engines.
6435 A. J. Maginnis. Steam steering, controlling, and cushioning gear.
6446 J. Grantham. Pumps.
9449 J. & D. Paterson. Rotary engines.
6455 A. S. Hamand. Steam engines.
6462 F. Carre. Feeding of steam engines.
6474 G. W. Manual & R. Marshall. Stuffing boxes and packing for steam engines.
6492 T. Thorp. Pressure gauges and pressure registers.
6496 J. S. Waite. Rudders for boats.
6498 W. & J. Lawrence. Surface condensers.
6499 W. Schmidt. Steam engines.
6505 R. R. Kelly & A. C. L. Weigel. Filtering.
6506 A. D. Bryce-Douglas. Link motion for working the slides of steam engines.
6513 A. P. Sharp. Guiding torpedoes.
6517 W. Kennish. Explosive projectiles.
6522 A. H. B. Sharpe. Steam boilers.
6533 B. C. Tilghman. Shaft couplings.
6550 L. Budini. Bearings.
6563 J. G. Lorrain. Portable naval telegraphs.
6572 H. Montgomerie. Sliding fire-grate for marine boilers, &c.
6573 T. Tomlinson. Steam boilers.
6576 G. E. Montagnon. Engines.
6588 W. Walley & T. Gare. Flexible shafts.
6591 H. S. Maxim. Guns and explosive projectiles.
6597 F. J. Rooker. Speed indicator.
6605 Clark (S. Haigh). Automatic feed apparatus for steam boilers.

6610 W. Brock. Compound steam engines.
6611 Hunt (C. Giebeler). Sluice valves.
6614 A. Dexter. Discharging from guns or mortars projectiles.
6619 R. J. Rae. Propellers.
6627 R. Wyllie. Utilisation of the otherwise waste heat from steam engines.
6634 O. G. Bolitho. Propelling vessels.
6638 T. Hampton. Steel armour plates.
6646 C. E. Chamberland. Filtering.
6650 F. Friedenthal. Circle screw propellers.
6665 J. S. Williams. Insulating electrical cables.
6670 F. Hockling. Packing for stuffing boxes.
6671 R. E. Dickinson. Exhausting and pumping.
6722 T. Foster. Boring, facing, and drilling the flanges of steam engines.
6724 C. W. Folkard. Pressure gauges.
6728 D. Young. A method of raising or floating of sunken or stranded ships, and making them unsinkable.
6737 W. Walton. Rotary engine.
6740 J. T. Titus. Couplings for pipes and hose.
6761 J. Murphy. Application of cold air forced through condenser tubes.
6778 P. Hodges. Crank shafts.
6779 T. Horton. Pressure gauges.
6817 Groth (J. H. Lancaster). Spirally corrugated vertical tubular boiler.
6818 Groth (J. H. Lancaster). Sectional safety steam boilers.
6827 J. Cort & S. Stevenson. Valves.
6830 Mewburn (Le Société D. Bouree et Frélezeau freres). Steam engine.
6851 A. W. Pearce. Condensers for ships.
6855 J. P. Binns. Driving gear.
6857 A. B. Scarborough & J. D. Barnard. Steam boiler cleaners.
6862. R. J. White. Rotary motors.
6865 A. Reis. Steam generator.
6885 W. R. Oswald & G. Brodrick. Filtering.
6892 T. T. Clarke. Feeding boilers.
6895 T. & J. Hill. Automatic lubricator.
6897 R. Bentley & T. Ford. Equilibrium slide valve for steam engines.
6898 C. J. Jones. Water tube steam boilers.
6901 P. P. S. y Chico. Aiming and determining the time for discharging or launching torpedoes.
6921 E. F. Elliott & F. W. Shovey. Ascertaining the amount of play of any shaft.
6924 A. Adams & J. J. Miller. Oars, sculls, and paddles.
6925 G. Adamson & J. T. Fenwick. Bow stoppers for anchor cables.
6926 H. S. Maxim. Explosive compounds.
6927 G. A. Mower. Lubricators.
6929 B. G. Martin. Valves.
6944 Stead (D. Moore). Machines for loading cartridge shells for shot guns.
6983 W. Welch. Torpedoes and submarine vessels.
6996 G. A. Newton. Steamships and the propulsion and steering thereof.
7001 F. O. Bynoe. Valves.
7012 J. Engelson. Steam generators.
7024 Newton (C. R. Crane). Hydraulic valves.
7030 G. Hughes. Rowlocks for boats.
7031 Day (W. A. Cockrell). Devices for cleaning ships' bottoms.
7036 H. Otway & F. S. Snowdon. Steam engines.
7045 Lake (R. Cox). Steam engines.
7073 T. Crowford. Increasing the speed of boats.
7092 Boult (P. Macabies). Lubricators.
7105 H. Bromley. Regulating lubricator.
7116 A. Thornton & S. Roberts. Pistons of engines.
7119 E. Schergen. Rotary pumps.
7121 D. Melville & J. F. Whitney. Paints for coating ships' bottoms.
7133 G. C. Offen. Piston for reciprocating engines.
7164 Thompson (R. Wrigley). Lubricators.
7167 T. Beddows & J. Brown. Preventing steam-boiler explosions.
7172 J. Womersley. Steam engines.
7175 J. Young & J. Richardson. Indicating and registering the speed of ships.
7184 J. Dewrance & G. H. Wall. Asbestos packed cocks.
7196 G. H. Leane. Deep water diving apparatus.
7237 Imray (La Compagnie de Fives-Lille). Continuously acting centrifugal apparatus.
7238 W. Westlake. Boiler and other furnaces and fire-places.
7245 J. S. Williams. Constructing and operating explosive projectiles.
7246 J. S. Williams. Constructing, operating, and controlling vessels.
7270 R. H. T. Plumb. Compass and course corrector for ships.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

May 23rd, 1885.

Aldridge, Geo. .. 2C Sthmpton
Ash, Rt. C. .... 2C W H'pool
Baily, Wm. J. .. 2C Cardiff
Bang, N. H. .... 1C Snderland
Banks, A. J. .... 2C ,,
Barrie, A. E. .. 1C Sthmpton
Bethell, Walter.. 2C London
Bostner, H. E. .. 2C Snderland
Bousie, Geo. .... 2C Liverpool
Brown, Fredk. .. 1C Leith
Canavan, D. J... 2C Cork
Clark, Herbert .. 2C Snderland
Daniel, N. T. .. 1C Cardiff
Dobson, C. W... 2C Snderland
Evans, Wm. T.. 1C Cardiff
Ford, J. .... 1C W H'pool
Fife, W. O. .... 1C London
Gardiner, Wm... 1C ,,
Gibb, Wm. .... 1C Glasgow
Grant, A. A. .... 2C Dundee
Heggie, David .. 2C Belfast
Harrison, Joseph 1C Liverpool
Harvey, Wm. .. 1C N Shields
Hudson, A. E. .. 2C ,,
Hudson, Thos. .. 2C Snderland
Isaac, Wm. .... 2C Cardiff
Jackson, A. S. .. 1C Snderland
Johnson, Hugh.. 2C Liverpool
Kennaugh, W. B. 2C London
Kenshole, J. E.. 2C Cardiff
Llewellyn, John. 2C ,,
Longvilli, J. E.. 1C N Shields
Mandell, J....... 1C W H'pool
McChlerne, A. .. Liverpool
McGeorge, J. .. 2C Snderland
Prior, Hugh .... 2C N Shields
Queen, W. .... 2C Belfast
Royal, Robt..... 2C N Shields
Ryan, F. A. .... 2C ,,
Scott, George .. 2C ,,
Sinclair, Geo. .. 1C Aberdeen
Smith, John W.. 2C W H'pool
Smith, Wm. .... 2C London
Stewart, Wm. .. 2C Dundee
Wallace, Thos. .. 1C Snderland
Ward, Wm. .... 1C Cardiff
Webb, James .. 1C London
Wyndham, N. S. 1C Cardiff
Yates, C. E. .... 1C Liverpool

May 30th, 1885.

Beach, Thos. N. . 2C London
Chisholm, Hugh. 1C ,,
Christie, Alex. .. 2C Glasgow
Dutton, J. G. .. 2C London
Gavin, C. .... 2C Glasgow
Grant, Alex. .... 2C ,,
Hair, John....... 2C London
Jacklin, George.. 1C Hull
Lloyd, Geo. C. .. 2C Liverpool
Maclean, Donald. 2C Glasgow
Main, John .... 2C Aberdeen
Marshall, Robt.E. 1C Glasgow
McCall, John.... 2C ,,
McKechnie, C. .. 1C London
Meadham, C. F.. 2C ,,
Morrison, Wm... 1C Glasgow
Mumford, N...... 2C Glasgow
Ogilvie, A....... *ExC* Dundee
Power, G. S..... 1C London
Richards, Geo. B. 2C Liverpool
Ross, Henry G... 1C ,,
Rutter, E. W. .. 1C Hull
Smith, William.. 2C London
Tyson, Thomas... 2C Liverpool
Watt, James .... 1C Glasgow
Wotherspoon, R.. 1C ,,
Wright A....... 1C ,,
Yabsley, Jas. S... 2C Liverpool

June 6th, 1885.

Allen, T. ...... 2C Liverpool
Blair, John .... 2C Bristol
Brinton, J. F. .. 2C N Shields
Foord, C. J. .... 1C ,,
Hill, Mozart .... 1C ,,
Holden, J....... 1C Liverpool
Hollingworth, A. 1C ,,
Killender, J..... 2C ,,
Pollock, Thos. .. 1C ,,
Savage, Robert.. 2C ,,
Speirs, Peter .... 1C ,,

June 13th, 1885.

Barker W. J. .. 2C W H'pool
Blenkinson, Rob. 2C ,,
Boulding, R. J... 2C Leith
Brabban, R...... 1C N Shields
Brown, J. J..... 2C W H'pool
Cassady, John .. 1C London
Chatterton, Louis 1C Hull
Currie, C. D..... 1C Leith
Davidson, J. .... 1C Cardiff
Earle, C. H. .... 1C Plymouth
Eynon, John.... 2C Cardiff
Fisher, Alex..... 1C Greenock
Gates, Roger.... 2C Liverpool
Gibbison, Thos... 2C N Shields
Green, Wm. J... 2C Glasgow
Griffith, Lewis R. 2C Liverpool
Hirst, John...... 2C Hull
Horsburgh, Alex. 2C Leith
Hyde, Alex. .... 1C N Shields
Iliff, Alfred .... 2C London
Jaques, G....... 1C N Shields
Jarvie, J. D..... 1C Greenock
Joseph, D. J. .. 2C Hull
Lindsay, James.. 2C W H'pool
Linton, Adam .. 1C Leith
Logan, Walter .. 2C Greenock
Marshall, Alex... 2C Leith
McKinnon, J. .. 1C Greenock
Muir, Wm. .... 1C Glasgow
Parminter, W. T. 2C Liverpool
Sanderson, C. E.. 1C W H'pool
Snook, Wm. .... 1C Cardiff
Sountag, J. .... 1C ,,
Sturrock, Alex... 2C Leith
Thornburn, Rich. 1C ,,
Walker, Peter .. 2C Glasgow
Waterworth, H.J. 1C N Shields
Watson, Andrews *Ex* CE Leith
Weir, John W... 1C Leith

The Marine Engineer.

LONDON, AUGUST 1, 1885.

EDITORIAL NOTES.

By far the most vexed controversy connected with naval construction, is whether the extremities of line-of-battle ships, should be armoured or unarmoured. The advocates of the central-citadel class, championed by Mr. W. H. White, appear to have better arguments for the adoption of ships of this type, than their opponents, headed by Sir Edward Reed, have for those of the full belted class. The polemical discussions by these eminent naval architects have been very critical and well sustained; but probably the most appreciable communications on the subject are those contained in the lectures delivered at the Royal Naval College, Greenwich, in February last, by Mr. W. E. Smith, Instructor in Naval Architecture at that institution, and Assistant Constructor at the Admiralty. The relative advantages and disadvantages of the central-citadel and ample belted systems are fully and judiciously pointed out, from which statements it appears that the former is the better of the two. This angry question is not, however, likely to be satisfactorily settled, unless such efficient experiments are made which the Admiralty are not likely to conduct. It appears that a sufficient protection against shot and shell is afforded by cofferdam, a recently invented composition, which beyond being efficient as a protector, has the required merit of being light. Being prepared from cocoanut cellulose, it has the excellent property when penetrated of closing up as rapidly as it has been shot through, and therefore there can be no influx of water into the ship's hold. A French Commission, at Toulon, have lately made some important experiments with the composition, which prove that it will probably be very useful to adopt for war ships. It has not, however, been shown, whether it will render ships unsinkable; but we believe further experiments are to be made to thoroughly test this question. The result of these several experiments should be carefully noticed by all interested in the future of Naval construction, and whatever the conclusions may be, it is advisable that to secure better men-of-war, the particular type of such be decided not by individual naval constructors who have novel schemes, but by a Board of Design to be formed by the selection of the most competent Admiralty and Naval officers. If this plan is adopted, not only will we avoid the long, tedious, and angry disputes about the relative merits of battle ships, but we shall have far better war ships at less cost, and far more expeditiously constructed.

The shipping trade are agitating for an improved accommodation in the harbour at Aden. As nearly all the shipping which passes through the Suez Canal calls at this harbour, it is of great importance to such trade that the vessels of usual draught should be accommodated at a convenient spot for loading and unloading, and shall also be able to enter and leave at all times. The drawbacks to this harbour seem to be that comparative shallowness of water exists for some considerable distance from the foreshore or landing-place, thus obliging the modern vessels of deep draught to anchor at an inconvenient distance from the shore, if they desire to be free to enter and leave at all times of the tide. Some vessels make a point of entering the harbour on the top of the tide, so as to get as near to the foreshore as possible, but under such circumstances the falling tide leaves them aground in the mud at the bottom, and they are therefore held fast in the harbour until the return of the tide. The shipping trade, therefore, petitions the State to undertake dredging operations in order to provide a practicable draught of water close up to the shore; but a curious difficulty has arisen. It seems that many of the fortifications, lately completed and carried out, depend for their cover upon the shallow water existing close to the shore, and an outcry is being made by the military authorities that the proposed alterations will practically nullify the effect and value of the fortifications. We think of the two alternatives that the commercial interests involved are of greater importance than the possible danger to the military defences.

Some of the facts with regard to the construction and performance of the U.S. cruiser *Dolphin* are now coming out. Certain reports are to hand, and these show that the whole specification, design, and workmanship seem to be about equally in fault. There seems to be little doubt on all parts that the actual performance of the *Dolphin* is far short of the stipulated conditions, and practically renders her unfit for the service for which she was required. There also seems to be little doubt that there are radical defects in the strength and construction of her hull, though how far the specification or contractor is to blame seems to be a difficult question to decide. The vibration in the hull of the *Dolphin*, while running her trial distances, was so perceptible, even in

the smooth water of the Sound, that it is a fair deduction to make that she would be totally unfit for the straining of a heavy sea. In the second trial, also, the after crank pin became hot after a short run, this pin not having given trouble before. On close examination there seems to be but little doubt that this is owing to straining of the hull, consequent on the slight alteration in the adjustment of the pig-iron ballast and of the coal. As this alteration of weight does not seem to have exceeded more than five tons, one ought not to have anticipated any perceptible effect upon the hull. If straining of the hull really did ensue from this cause, as is believed and reported, the weakness of the hull must be most serious. Even the Examining and Reporting Board, who refused to consider the *Dolphin* a sufficient and satisfactory job, are bound to admit that the plans furnished to the contractor were very meagre, and would by no means provide for a vessel of adequate strength for the use for which the *Dolphin* was intended. While it is clear, then, that the plans are greatly at fault, and if carried out in the best manner would not have produced a vessel of sufficient strength, the Examining Board consider that the *Dolphin* exhibits a degree of weakness in excess of what can properly be entirely attributed to the defective plans. There seem, also, to have been several stipulations in the contract for which no adequate details were given for properly carrying the same into effect, and altogether the general terms of the specification on which the contract was made seem to have been merely a series of suggestions and stipulations in principle, without sufficient reference to any details for practically carrying the same into effect. Beyond all this the Examining Board stated it to be their conviction that in many respects the general workmanship is defective and second-rate, though absolute proof of such convictions are not to be readily arrived at without an actual dismantlement of the hull and interior arrangements of the vessel. Among some of the points severely criticised as to workmanship is the main deck of the vessel, which is stated to have been built of rough knotted boards, showing evidence of sap. The screws, which should have been placed in the body of the planks, have been placed in the seams, rendering proper caulking impossible, and converting the deck into a sieve, through which the water on stormy weather would pass, ruining the stores below. The general painting seems also to have been insufficient, and many evidences of rust are stated to be visible on part of the ironwork. The interior arrangements are also said to be bad, and not in accordance with the contract; the rudder is not protected, and is not provided with steam as well as hand steering apparatus. The contractor is, we believe, doing his utmost to fulfil the requirements of the contract, but we think he has been very unfairly handicapped by a specification which served only to hamper his discretion without stipulating the manner in which the work was desired to be carried out. We think our American cousins will now admit that they might still take some useful wrinkles from English marine engineers.

THE late stoppage in the water-way of the Suez Canal has pointed two very important lessons to the shipping world. The first is the ease with which such an obstruction has been caused, and the entire block of traffic that ensues, owing to the limited dimensions of the canal. The second important point has been that owing to the block, a very large number of the Pacific steamers have had to pass round the Cape route, instead of awaiting the delay caused by the obstruction, and that it has been found that with the high speeds now maintained by our ocean liners, such vessels were not more than three or four days' late as compared with the time usually occupied when passing through the Suez Canal. We think this latter point of the utmost importance. An idea seems to have been growing up very strongly, both in the minds of the shipping world, of the State, and of the nation at large, that the command of the Suez Canal, and a free transit through it, is a primary necessity for the maintenance of our communication with India and the Pacific Ocean. We cannot but think that late events have proved this idea to be somewhat fallacious, and that we should not be much the worse as a carrying nation, or as an Empire, if the Suez Canal did not exist at all. This latter view would certainly save many International complications at the present time, and probably to a greater degree in the near future. So long, however, as the Canal exists as a channel for the Eastern trade of the world, it is of the utmost importance that communication should be uniformly maintained, and in no way subject to unforeseen interruptions. Dredgers, as at present constructed, will always be a source of danger to the Canal. They are easily sunk, being in no way divided into water-tight compartments. They are unwieldly, and, remaining stationary, have no means for avoiding the threatened collision with a passing vessel. It is an important question to our mind whether such a system of dredging in a restricted water-way is not a mistake. We would like to see a device suggested and put into practical operation, by which each vessel in its

passage might be utilised, by a suitable apparatus, to dredge such portions of the channel as might need it in their passage. This would mean a constant removal of the silt which accumulates in the channel, as small in degree and as continuous in its operation as is the accumulation of such an obstruction. If such a system and device could be put into practical operation, it would entirely dispense with stationary dredgers in the channel at all, and thus at once remove the danger of a collision with them in mid-channel. Should this not be practicable, at least many improvements in the dredgers themselves can be devised, by which they could be rendered more buoyant and less likely to be sunk by accident. There would be many ways of carrying this into effect, well within the ordinary skill of a ship draughtsman, or marine engineer, and we recommend the subject to their attention.

A GOOD deal of attention is now being directed to the subject of forced combustion as compared with natural draught, and a good deal of information has been collected with regard to results. We see that the West India steamer *New York City* has been fitted by Messrs. Howden & Co. with a new boiler in May, 1884, provided with their system of forced draught. The new boiler so fitted was of considerably smaller dimensions than the old one which it has replaced, the new boiler being 11 ft. long by 14 ft. diameter, as compared with the old boiler, which was 17 ft. long by 12 ft. 6 in. diameter. The heating surface also in the new boiler was only 1,319 square ft. as compared with 2,173 square ft. in the former, and the grate surface in the new boiler is 36 square ft. as against 75 square ft. in the old one, that is rather less than half. The forced air supply is provided by a 36-in. Gunther fan, working at 190 revolutions, driven by a donkey engine, and the whole apparatus seems to have worked without a hitch, during the two voyages, outwards and homewards, of which we have a report before us. It has been generally credited to the advantage of such a system that a large increase of evaporation per square ft. of firegrate can be accomplished, and we find it to be reported that as much as 20 I.H.P. per square ft. of firegrate has been obtained from this boiler on the *New York City* steamship. The trade at large also will probably be prepared for the statement that even with the small boiler with forced combustion a considerable total increase of I.H.P. was obtained, as compared with the maximum obtainable in the old boiler, the average revolutions being as much as 60, as against 56 in a former voyage, with an almost exactly similar loading, the I.H.P. being taken as 623 under the new conditions, as compared with 564 under the old. The most startling accompaniment, however, of this result is that it has been effected with a large saving in fuel, the consumption of Welsh coal per 24 hours being respectively 9½ tons in the voyage with the new boiler, as compared with the consumption of 15 tons with the old boiler. This makes a reduction in the consumption of coal for the same engines from 2·24 lbs. to 1·42 lbs. per I.H.P. per hour. In addition to this important feature of increased power and greater economy there are many well known side advantages accompanying such a forced combustion. One is the perfect control thereby given, as the air supply can be immediately shut off, and combustion almost entirely checked. The absence of smoke, and the coolness of the stoke-hole, are very marked features attending this system of forced combustion, and the general working of such systems have shown that no special knowledge is required practically for their superintendence.

VOLUNTEER COAST DEFENCE.

UNDER the heading of "Torpedo Warfare," in the July Number of this Journal, we advocated, in forcible terms, the construction of 300 torpedo boats for the defence and security of the coast and seaports of the United Kingdom. We said, distinctly, that with such a force the country would be able to dispense with Channel squadrons for coast defence; but there was no intimation in that article as to relieving the Government of one of its most important duties of defending such coasts and harbours.

Since that article was written, two or three public meetings, under distinguished patronage, have been held, with the object of setting on foot such a measure of defence. The first was presided over by Cardinal Manning, and was started by the Thames watermen, towards defending that river and the approaches to London by means of torpedo boats, or tug boats fitted with torpedoes. Their idea was, that if Government would supply the means, in the shape of boats, they would be glad to volunteer as crews, and learn the duties of volunteer defenders under competent naval officers. The second and greater scheme was, if not conceived by Earl Cowper, introduced by him, and supported by distinguished members of the aristocracy, the Navy, and Army. These prominent public men appear to be fully alive to the advantages and to the necessity of supplying our harbours with torpedo boats; but they, in a measure, go a step further than ourselves, and would have the funds for building and equipping such vessels raised by "local efforts," and assisted by an international subscription, which is to supply one-fourth, or one-fifth of the money required. If the Government, which lavishes four millions of money upon Egyptian wars; gives five thousand a year to gentlemen who fill useless offices; and expends so many thousands in keeping up Royal yachts, which are seldom used by Royal personages; cannot find the funds for supplying coast defence, there are few Englishmen who would hold aloof from a great national subscription to such an end; but, until it can be distinctly understood that the Government is unable to supply such cheap and effective defence, Earl Cowper and his noble supporters will have some little trouble either in collecting the money, or in persuading the residents of the seaport towns that a Government which cannot perform a plain and important duty should be permitted any longer to have charge of the destinies of the Empire.

Admiral Sir Cooper Key told the meeting that he had advocated the scheme years ago, when he was a Lord of the Admiralty, and that he did not consider the country ought to look to the Navy for the defence of the ports. Sir Andrew Clark, Inspector of Fortifications, who attended the meeting as the representative of

the Army, did not express himself as to how far he considered the Army ought to take part in the defence of the coast ports, but he declared himself a supporter of the subscription scheme. If we had no Army, and no Navy, it is highly probable that the people themselves would quickly set about creating some kind of defence to take the place of such; but the idea of Admiral Key in absolving the Navy from all the duties of defending the coast towns is one which, coming from a naval officer of position, will somewhat astonish great numbers of his countrymen.

Another speaker at this meeting said, that as the great Army Volunteer force had been established by private enterprise for the defence of the interior, there was no reason why the coast towns should not be defended in the same way, by private efforts. He might have called it a Volunteer Navy, for such a force as is wanted, would be nothing less.

To find a parallel case for the Army Volunteers, who, it is alleged, are for the purpose of defending the interior, it is only necessary to call for Volunteers in the seaport towns to man the ships of the Navy, and we have it at once, neither more nor less.

The money which pays for the rifles and ammunition of such a force comes from the national exchequer, and, indirectly, from the pockets of the community at large, who, it may be supposed, will always be very glad to be defended on such terms; and why the money for building and equipping torpedo-boats should not emanate from the same source, and in the same way, great numbers of Earl Cowper's countrymen will fail to see. They will believe that if the sea-coast towns find the men, who are to carry their lives in their hands in such hazardous warfare, it would only be the most common fairness, that Government should find the ships.

Earl Cowper is to be congratulated, and to be sincerely thanked, for putting the question of coast defence by torpedo-boats, on a more secure and advanced footing than it has previously enjoyed; but the proposition for relieving the Government of such a most important, and imperative duty, of supplying the vessels and their officers, is one which we cannot support so willingly as could be desired. The great drawback it appears to have is that of shifting responsibilities from the schoolmaster to the scholars, or from the captain and his officers to the crew. It is an attempt to relieve every single individual in the country, or, at least, in the interior parts of the country, of one of the first duties of citizens and patriots, and that is, compulsory means of providing for adequate defence, and to shift such obligations from their shoulders to those of others, from the shoulders of the many, to those of the few.

But the most objectionable feature appears to be in relieving the Government of one of the most serious duties of their office, and in establishing possible precedents, which may lead to very grave issues.

If the difficulty is money only, which cannot be raised by the ordinary system of taxation from the thirty millions of the whole Kingdom, how may we expect that the comparatively few of the seaport towns are going to find it? Why, for example, should the comparatively few and poor townspeople of Bridlington be expected, single handed, to find the means of driving away an adventurous enemy, who was bent, not so much in destroying their town and slaughtering themselves, but in ultimately effecting a landing in that part of Yorkshire, and in pillaging and burning the old historic city at the back? And why should other rich and flourishing cities, not far away, be permitted to escape a mere trifling, but vital tax, to which they would willingly contribute, while the fewer numbers in poorer districts were not only finding the money, but doing the work of repelling national enemies?

Earl Cowper endeavoured to find a precedent in such a course by reviewing the circumstances surrounding the Spanish Armada and its destruction, in great measure, by private enterprise; but however ingenious such an argument, it is not a fair illustration of present conditions. We were, by the invasion of our Spanish neighbours, taken, in a measure, unawares, and everything in the shape of a ship and a sailor was, if not voluntarily offered, compelled to come in. The merchant ships which fought in that decisive battle, were lying in port idle, and with their crews would have remained idle, as long as the Spanish ships dominated the Channel.

They were ships which, though built essentially for trading purposes, were also, along with their crews, capable of fighting, and did regularly fight their way against individual enemies in all parts of the world. But, although the country had its private resources, such powerful assistance in the shape of ships and of men, that did not stop Elizabeth and her ministers in equipping, at the first opportunity, a navy which should be, as far as was possible, independent of merchant ship assistance. This was done by Blake and his contemporary admirals, when the country was immeasurably poor, compared with our present wealth, and possibly the foundations were then laid of that great navy and its system which, under other admirals like Blake, by a magnificent series of successes, "called forth the spontaneous shouts of admiring nations." It is very doubtful whether a force of torpedo-boats, not under direct Admiralty supervision and control, would be either popular or safe in the hands of private individuals.

They should be commanded by naval officers who had been specially educated in a torpedo school, and these officers would, of course, take their orders on all occasions from the Admiralty. Without such, its organisation would scarcely attain a necessary proficiency for safe and effective work, in the presence of the enemy.

If there is not a special training school for torpedo warfare, the Government should have one with as little delay as possible, and as officers became perfect in the drill, let them be despatched to the seaport towns to drill and educate the Volunteers, who will be ready enough to join existing boats.

It is said that there are already six thousand men on London rivers, ready and eager to join anything which a benevolent Government will furnish in the light of coast and river defence. What a pity the services of such ready-made seamen, or watermen, cannot be accepted. These men, who live upon the river, have lately been asking the Government to take them up for the defence of the four millions of London citizens, and their vast accumulation of wealth; compared with which the emoluments for such hazardous service, would be small indeed.

But whatever is doing in this direction, as long as we have a Government, must be done by it and its officers, who should think themselves fortunate that they live in times when men can be had without the costly and horrible system of pressing. The great wealth of the country can, by a judicious system of taxation, raise funds enough to build and equip not less than 300 sea-going torpedo-boats of the first class, and costing £13,000 each, or whatever other sum it may be.

Four millions, expended in this way, would be about the cheapest and most effective means of securing safety on the one hand, and general peace on the other, for, as Cardinal Manning well observed, in presiding over the Thames Watermen's meeting, We want a strong navy to keep our friends from picking and stealing.

Places like London, Hull, Liverpool, Glasgow, and Newcastle should have not less than a dozen boats each, all capable of steaming at the highest possible speed, through rough head-seas, and of keeping the sea, if by any possibility it were found necessary. They should be of such power and proportions as to make a fairly good passage from port to port, in order to join action against a common enemy. Such towns as Plymouth and Portsmouth would, of course, be carefully looked after. Other places round the coast, like Brighton and Aberdeen, Dublin, or Queenstown, should have not less than half a dozen each, and no town with more than seven thousand inhabitants less than two boats of the second class.

If the most prominent speakers at that meeting, like the Dukes of Northumberland and Sutherland, were correctly reported at Earl Cowper's meeting, it would appear that the flotilla under notice would act only in defence of that port in which it had been mainly subscribed for; thus, if Southampton, Portsmouth, Brighton and Hastings were already provided for, but by some accidental circumstance Bognor, Worthing and Shoreham were not, they should be left undefended, and at the mercy of the enemy, who attacked only such places as had no defensive provision. This would be reversing the policy of joint action against enemies with a vengeance, and if carried out we might next expect to hear that in the event of an invading army attempting a landing on the east coast, all the soldiers of the central and western shires were to stop at home and leave the Easterns to settle their little accounts by themselves. If Whitby, for example, had provided herself with boats, and Scarborough had not, on the assumption that the necessity had not arisen, or from various other circumstances, it would hardly be fair that when there *was* a necessity, the former town should send the latter assistance, and leave herself undefended. By Earl Cowper's method of subscription, there is nothing to stop such places as Hull and Newcastle from providing themselves with a dozen boats each, and all the intermediate seaports having none, and being left to the mercy of any modern Paul Jones. The two former towns would be quite within their right in refusing to allow their own vessels to leave them while the enemy was on the coast, or of leaving them under any conditions.

If such vessels had been provided by the Government, all

difficulties of this kind would not crop up, for such boats would be considered the property of the nation at large, and not that of any particular seaport. If provided, as Earl Cowper suggests, it will be found that in the event of war they will have to be taken over by the Government, to be of any value. For perfect and reliable defence the seaport towns must have cannon as well as boats, and although there would be much more reason in paying for cannon by subscription, still that would be transferring a national responsibility also, from the many to the few, or from the Government to the people; it would be imposing heavy expenses on the coast towns, which should be spread over the whole country. Placed upon some point of vantage, each town should have from two to a dozen cannon, of exceptionally long range, and penetrative power, and this would give some employment to the eager thousands who, without such cannon, could only sit down and pray for the success of the handful of their townsmen, who had gone out to meet the enemy in a few small boats, and possibly on the forlornest hope which warlike Britons ever entertained. These guns should be placed upon the hill-tops, and defended by earthworks or sand-bags, not by stone or iron casemates. The latter take long to construct, require skilled men to do it, and cost great sums of money, after which they are readily destroyed by shot. The former can be constructed between sunset and sunrise, by women and children, if men cannot be had. When struck by shot they throw off no splinters, and as fast as holes are made in such defences, they can be again filled up, if not immediately, at least during the following night. Defensive walls, fifty feet thick, can be built up during the night by any kind of unskilled labour, and there are few of the modern shot which would penetrate this kind of defence, properly constructed under the superintendence of a couple of Royal Engineer officers.

One very powerful reason why the Government should supply torpedo-boats, and be entirely responsible for their movements, is that, although each port would be provided with some, according to population, it would be necessary, in order to make their power felt, that they should act together in hundreds upon any point threatened, and within 80 or 100 miles of the harbour in which they are stationed. If, after an encounter, six were destroyed by the enemy, it would be absurd to expect that the same town which had equipped them in the first instance, was to again replace them by others, after being lost in defending a possibly more wealthy city, a hundred miles away. Messrs. Yarrow & Co., the enterprising builders of torpedo-boats at Poplar, London, furnish, in a lecture given by the head of the firm, some very instructive remarks as to the abilities of torpedo-boats to keep the sea in all weathers, and to perform ocean voyages under sail alone.

After the *Batoum*, which they built for the Russians, and which steamed out from London to Nikolaief, a distance of 4,800 miles, in eighteen days, they sent several a still longer voyage to the Argentine Government, in South America, and this necessitated the passage being made by the aid of sails alone. They were carried safely, and one of them sent home a report of riding out a heavy gale, which she encountered on the journey. This may establish the fact scarcely believed in by naval experts, that they could live through a gale of wind if overtaken by such, between ports. It does not, however, establish any such theory that they can make passages with fair or necessary progress through such strong or moderate winds and seas as frequently ruffle the waters of the British coast. And when they are spoken of as doing 20 knots an hour, or occasionally 22 knots, as some of the vessels of this firm have, it refers to the smooth waters of rivers and harbours, and not necessarily to the open sea. A hundred foot boat is too small to attempt anything like attack at sea in all weathers, or even defence, and particularly about this country, where the weather is so changeable. If she happened to find herself at any time to *windward* of a 12-knot ship she would, if the sea were choppy, possibly be overhauled and sunk, for it is very doubtful if boats under 150 ft., or from that to 200, could keep up more than 12 knots in rough water. It should, beyond this desideratum of speed, be our object to keep torpedo-boats as small as possible, and the better plan would be to have them mixed in sizes, ranging from 80 to 180 ft. in length.

The four belted cruisers, the drawings of which have been prepared at Chatham, will be protected by 10 in. steel armour backed by 10 in. of wood and felt. This armour to extend four-sixths of the whole length of the vessel. The armament will consist of ten 6 in. breechloading guns, two 9 in. mounting *en barbette*, four Hotchkiss, and eight Nordenfelts. The speed is estimated at 18½ knots and the coal storage about 650 tons.

THE LESSON OF THE EVOLUTIONARY SQUADRON.

NOW that the cruise of the Evolutionary Squadron is practically over, writes a correspondent of the *Times*, it may be well to briefly consider what experience of value has been gained by it. In the first place, the utility of booms, however strongly constructed, for defence, has proved to be just what most people thought it was. They are impervious to the attack of boats, torpedoes or others, but offer no resistance whatever to the rush of a ship moving at speed. The resources of a modern squadron of ironclads, moreover, would be quite inadequate to their construction on the scale of those at Berehaven, unless it were accompanied by a timber-laden ship for that special purpose.

Torpedo boats must be divided, as heretofore, into two classes, but the line of demarcation between them must be much more strictly drawn. The two boats of the "Childers" type that accompanied the Squadron are probably safe in any ordinary sea, but anything smaller is not. The other so-called first-class boats are not only uncomfortable to a degree that can hardly be imagined, but are positively dangerous in very moderate weather. And the fact of their being under convoy is hardly any security to them. If one of them were to be swamped, the ship alongside which she was steaming could scarcely render any assistance, but would probably helplessly see her go down with all hands before her eyes. Another abuse of torpedo boats, which should never be allowed, is employing them for towing purposes. They are necessarily of frail construction and propelled by delicate machinery, and yet it was an everyday occurrence in Bantry Bay to see one of them straining her utmost to drag three or four heavy launches or a long train of spars behind her. Her engines were naturally strained and injured, even if they did not actually break down at the time. And this brings us to put on record how almost incalculably valuable to a fleet are such ships as the *Seahorse* and *Hecla*. If the *Seahorse* had been at Berehaven, the torpedo boats would not have had to do the duty of tugs, and if the *Hecla* had not been there they could not have been repaired. Perhaps no more need be said. The *Polyphemus* has turned out a complete and brilliant success. All doubts as to her sea-going qualities have been set at rest, and in the hands of such an officer as Captain Jeffreys she has proved herself a miracle of agility. The *Ajax* is not nearly as bad as she has been painted, though her steering capabilities still leave much to be desired. The *Rupert* and *Hotspur* are two extremely useful and formidable ironclads of the second class. The *Oregon* is invaluable as a scout. The gunboats, whether *River* or *Rendel*, are utterly useless as accessories to a sea-going squadron, and it is only fair to say that their designers never intended them for any such service. The former class have not a single redeeming quality, and the *Pike* or *Snap*, if towed at 10 knots, would infallibly go down, filling themselves with water forward on account of the 18-ton gun in their bows. But gunboats of a proper class would be of the greatest use for many different purposes, as the *Express* showed. A number of vessels of her size, model and armament, but built of steel and two knots faster, would be most serviceable. Speed is a very important factor of efficiency, no doubt, but it will be years before a British fleet will be able to act in combination at a much higher rate than 11 knots; nor is it likely that any foreign fleet will be better off in this respect, regard being had to the slow ships that none of us can afford to throw away. Hence, gunboats of 12 knots would have a long future of usefulness before them. It is only fair to add that two or three gunboats of the *Snap* and *Pike* class ought to be found in all British harbours that need defending. Of small cost, occupying but little room, mere floating platforms for their one really formidable gun, they are admirably adapted for coast defence in the strictest sense of the term, and might be easily manned for the most part by volunteers, who would soon come to thoroughly understand the method of working them. Opinions are still divided as to the merits of the electric light for search purposes, and it does not seem that anything new has been learned about submarine mines or torpedo nets. Perhaps the subject exciting most interest just now is the composition of the new Channel Squadron. Is it still to consist of obsolete ships like the *Minotaur*, or are we to have a group of real fighting men-of-war? If there were no other arguments to urge in favour of the latter course, it would surely be wise to commission such ironclads as the *Edinburgh*, *Colossus*, *Collingwood*, and *Conqueror* as soon as possible, so that captains, instead of rusting on half-pay for four or five years after attaining that rank, might have an opportunity of learning in time of peace something about the ships they would be called on to handle in time of war.

TORPEDO WARFARE.

COMBATIVENESS is one of the essential attributes of the human race, more especially in the case of soldiers and sailors, whose business it is to carefully train this quality. Physical combat having of late years been of very rare occurrence with our naval forces, naval men sought satisfaction in an animated controversy upon the respective merits of guns and armour. Now that that subject is very nearly exhausted the gauntlet has been thrown down by an officer of high position and great repute, inciting to a controversy upon guns and torpedoes. The torpedo, by reason of the admiration which its wonderful mechanism creates, and of the ardent zeal with which its cause has been taken up by skilled officers, has gained the reputation of being the most effective weapon in the Navy.

Hobart Pasha, the Admiral of the Turkish fleet, in an article written by him in *Blackwood's Magazine*, has made a strong effort to weaken this opinion. He points out that in no case where the locomotive torpedo was used has it succeeded in blowing up the vessel against which it was launched, and states his belief that in actual warfare it would have very little effect towards deciding an action. As far as actual experience with this deadly machine goes, it must be allowed that he is justified in his opinion. A few cases of attack by Whitehead torpedoes occurred against ships of the Turkish fleet commanded by Hobart Pasha, during the time of the war between Turkey and Russia, and in no case was the object intended attained. On one occasion one of these weapons was discovered by the Turks debasing its power by displaying itself on the beach before a number of ignorant fishermen, who were naturally much startled at seeing so strange a monster, half fish, half machine, squirting and spluttering in the sand. It appears that, though this object was launched straight towards the vessels lying in the harbour, it had been deflected from its course by impinging against a slight breakwater improvised for the occasion by the Turkish Admiral. A narrower escape was experienced at another time, the torpedo being obstructed simply by the mooring-chain of the threatened vessel. These were apparently the only two occasions upon which this kind of torpedo was used during that war. Several other interesting torpedo incidents are mentioned, but deal principally with the less scientific and less efficient Spar torpedo, and Harvey torpedo.

The British Navy registers but one case in which a fish torpedo was launched in real earnest, and that happened to be one in which it was perfectly impotent to do its work. During the engagement between the *Shah* and the *Huascar* in the Pacific the British Admiral determined to try the powers of the delicate little machine with its one charge of gun-cotton, against a formidable ironclad of over 1,000 tons, armed with 12-ton guns, and protected by four-inch armour. At the instant, however, of launching the torpedo, it happened that the *Huascar* altered her course, and, unfortunately for the dignity of the Whitehead torpedo, there was the spectacle of a pursuer, whose maximum speed was nine knots, in full chase of a vessel running at least eleven.

These experiences do not seem to lessen the intense awe with which these little instruments have always been regarded. A visitor on board a man-of-war, being brought face to face with one, hardly ever gives much attention to the elaborate descriptions of the courteous attendants. He certainly smiles knowingly, though nervously, nods his head constantly, and expresses assent to minute accounts of air-pressure chambers, Brotherhood engines, double propellers, and mechanical pistols. He eagerly professes to be quite clear upon machine questions: swallows down undigested operations of a most delicate and intricate character; and apparently bolts this valuable information with as much avidity as a child gulps down its dose of cod liver oil. Although he is constantly told, in answer to his oft-repeated question as to whether the thing is loaded, that it is not so, yet he does not regain his usual equanimity until he is well clear of the infernal chamber. Much will no doubt be done towards rendering the torpedo a popular character, by the fact that one of them is exhibited by the Government authorities at the Inventions Exhibition. Though at first the public was a little shy of the shining, sleek-looking demon, and generally stood off at a respectful distance, yet its really elegant form and harmless condition has gradually restored confidence to the crowds of daily visitors. Now the difficulty is to keep ardent admirers from closely hugging him, and leaving awkward looking finger marks on his brilliant hide.

It would be somewhat of a pity to have to think that this contrivance, worked up to such a perfect machine, studied closely by those who have to manage him, and becoming more understood and appreciated by the general public, should be perfectly useless. And we are inclined to think that, though his previous history has been hardly of a creditable character, yet that this is not due to any inherent defect, but rather because, at the period when it was practically tried, it had not attained to such perfection as a machine, and principally that it was not sufficiently examined and practised with. There are not wanting men of knowledge and ability ready to defend the cause of the torpedo. Articles are published in the principal journals, papers read at scientific institutions, and opinions freely and publicly expressed to the effect that under the present system, and with such circumstances as often occur, or can be made to occur in an action, that it would be scarcely possible for an attacked vessel to escape. For some years past torpedo practice and instruction has been a recognised institution in the Admiralty department. The torpedo school at Portsmouth is a most perfect establishment for developing the torpedo and for giving full instruction in its construction and practice. A large number of men of all grades, including both officers and seamen, pass through an excellent course extended over a long period, so that we might suppose that with this special training the torpedo would have a much better chance of success than it did when practice was of a meagre character and interest in the subject very confined.

Some of the information given by Hobart Pasha in his article would lead us to a very different conclusion from that to which he has himself arrived. The fact that he had to devise several ingenious and elaborate means to protect his ships, both when in harbour and when at sea, would show to us that the torpedo was by no means to be despised. Any attack which required such carefully organised systems of defence would seem to be of a really formidable character. These defences themselves are worth attention, being apparently effectual in their object, and constructed out of appliances that were readily at hand. Ships in harbour were defended by arranging a breakwater running from one point of the shore and extending out far enough to shelter the ships. This breakwater is composed of a series of trunks of trees, anchored to the bottom, to which is fixed planking dipping downwards into the sea sufficiently to obstruct a passing object. It was this arrangement that caused the before-mentioned torpedo to alter its course and land harmlessly on the beach. At sea, the vessels would anchor at night and be surrounded by a circle of guard boats placed certain distances apart. Each of these boats would be connected to its neighbour by stout chains dipping some two or three feet into the sea, the object of these chains being to entangle the screw of any torpedo-boat that should attempt to force the barrier.

It seems to us that the possibility of these precautions is just such as to establish more firmly the torpedo as a marine weapon. If the torpedo were harmless, it would quickly die a natural death; if it were so deadly as it might be if no precautions were taken, there would be an end to naval war, and we should then be inclined to agree with the gallant admiral that the only course a naval commander could take would be that of the animal in the gum tree, and cry out to his antagonist not to shoot, but would save him the trouble by coming down. There appears, therefore, to be just that amount of danger and safety in connection with the employment of the torpedo to make it a most effective weapon in actual war.

WE are pleased to advise our readers that, acting on the suggestion of several influential friends in Liverpool, and with a view to prevent delay in the delivery of castings for local orders, the Phosphor Bronze Co., Limited, have opened a branch foundry at No. 13, Litherland Alley, Liverpool, which will be under the superintendence of their sole district agents, Messrs. Hosking and Taylor, 18, Strand Street, Liverpool. The company now also undertake the supply of gun metals and anti-friction metals, and have lately produced some new specialities.

IN the latter part of last month, Messrs. Yarrow & Co. launched from their yard at Poplar one of the new large sea-going torpedo boats, of which forty were ordered by the Government at the time strained relations existed between this country and Russia. Twenty of these boats are being built by Messrs. Thornycroft and Co., and twenty by Messrs. Yarrow & Co. The one just launched by the Poplar firm is the first of the forty which has been put in the water, and the remainder, we believe, will follow in rapid succession, the two firms working under heavy penalties. These boats are 125 ft. in length by 13 ft. beam, and consequently much larger than any which took part in the late Bantry Bay manœuvres.

H.M.S. ALACRITY.

THE *Alacrity*, twin screw steel despatch vessel, 1,400 tons displacement, built by the Palmer Shipbuilding Company, has lately completed her highly successful series of steam trials in the Solent. The trials were conducted by Mr. J. P. Hall, on behalf of the contractors, and among those present on the occasion were Mr. Bakewell, from the Admiralty; Commander the Hon. F. R. Sandilands, in command of the ship; Mr. Alton, Chief Inspector of Machinery; Mr. Corner, of the Steam Department of the Dockyard; and Mr. J. Smith, chief engineer of the ship. The *Alacrity* is a sister ship to the *Surprise*, recently described in *The Times*, the only material difference being that her bunker capacity is somewhat less. She will carry 375 tons, as compared with the 400 tons of the *Surprise*; but even this reduced quantity will enable her, it is supposed, to steam at 15 knots for about 14 days. The vessel is propelled by two sets of compound engines, each having a high-pressure cylinder, 26 in. in diameter, and one low-pressure cylinder, 50 in. in diameter, with a stroke of 34 in. The main engines are horizontal, each pair being fitted with a horizontal air pump driven from the crank shafts. Her crank shafts are of Vickers steel, while the propeller shafting and the cylinder liners are made of Whitworth fluid compressed steel.

The propellers themselves are composed entirely of gun metal. There are two large horizontal condensers, formed also of gun metal, the water being circulated by two pairs of centrifugal pumps made by Allen. The fans and casings are likewise made wholly of gun metal. The pumps are fitted with large suctions from the bilges, and are thus capable of dealing with a considerable leak. Four special engines are provided for feeding the boilers, while two others, of similar design, pump out the bilges, and can also be employed as fire engines. The main engines are fitted with steam reversing gear of simple construction, and can be handled very easily. The piston and other glands are packed with the new patent asbestos cloth packing. Steam is provided by four steel boilers, two being 9 ft. 6 in. in diameter, and two 10 ft. 4 in., the length of all being 17 ft. 6 in. The working pressure is 100 lb. to the square inch. The stokeholds are fitted with arrangements for forced draught, the air being supplied by four centrifugal fans 4½ ft. in diameter, driven by an independent engine. These are capable of maintaining an air pressure equal to 2 in. of water.

The natural draught trial was made under favourable auspices as regards weather, the immersion of the ship being 11 ft. 2 in. forward and 10 ft. 6 in. aft. The engines were kept working at full power continuously for four hours, the means of the observations giving the following results:—Steam in boilers 92·63 lb., vacuum 26 in. and 25 in., revolutions 121 and 120 in the starboard and port engines, H.P. 1,087 and 1,070 horses in the two engines respectively, thus showing a collective power of 2,157, equal to 157 more than the contract, with a fuel consumption of 2·1 lb. per unit of H.P. developed. Her speed realised was 16·143 knots. At the four hours' continuous trial under forced draught, very gratifying results were obtained. The air pressure in the stoke holes did not exceed an inch as measured by the water gauge, but with this a perfect combustion was secured in the furnaces, and no want of steam was experienced. The mean pressure in the boilers on this occasion was 99·31 lb., about equal to their full working pressure, the vacuum 25·1 in. and 24·5 in., the revolutions 134·87 and 134·75 per minute, the H.P. 1565·73 and 1607·34 in the starboard and port engines respectively, and the total collective power indicated 3173·07 horses, or nearly 200 beyond the contract. The two engines worked well together, but the mean pressures in the cylinders of the port engine were somewhat higher than those of the starboard engine. The fuel consumption was 2·77 lb. per horse per hour, and the speed attained on the mile was 17·956 knots. Favourable as were the results extracted from the *Surprise* as regards power, speed and economy of coal, they were exceeded by the performances of the *Alacrity*. The engines worked admirably from first to last, and notwithstanding the enormous piston speed the bearing showed no signs of heating. On the conclusion of the run the turning powers of the ship were tested under full speed. Circling to starboard the circle was completed in 4 min. 5 sec., the port circle being performed in 4 min. 24 sec. The approximate diameters were 500 and 700 yards, or about from six to seven lengths of the ship. At the end of the trial the *Alacrity* returned into harbour, where she will be completed to replace the *Enchantress* as Admiralty yacht. As it is proposed, however, to arm her and her sister ship the *Surprise*, with six 5-in. breechloading guns and four 3-pounder quick-firing guns, she will not be ready for the use of their lordships on their forthcoming visits of inspection to the dockyards.

FAST RIVER STEAMER BEATEN BY A STEAM YACHT.

FOR many years the *Mary Powell*, side-wheel steamboat, has been the fastest on the River Hudson, and in 1882 was driven at the rate of 26 miles an hour for four miles. Many boats of all kinds have endeavoured to beat this Queen of the Hudson in running, but she has recently been vastly beaten on a long run of 30 miles by a small steam yacht, *Stiletto*, in an hour and a quarter. This yacht, which was designed and built by the Herreshoff Manufacturing Company, of Bristol, R.I., is 24 ft. long; over all, 90 ft.; on the water line, 11 ft. beam; and only weighs 28 tons. The hull, which is sharp at both ends, is double planked. The boat is covered by a slightly arched deck. She has a pilot-house forward, which is large enough to serve as a comfortable cabin, while on account of the very small space taken up by the engine and boiler rooms, there is sufficient space for comfortable quarters for the crew, and staterooms for the owners, officers, and guests. A compound condensing engine of 12-in. stroke, and cylinders of 12 by 21 in. in diameter, furnishes the power. The engine is supplied by a sectional water-tube boiler, wherein steam can be quickly got up, which is estimated at 450 H.P. The boiler-tubes are arranged horizontally in sets immediately over the fire, and each set are at right angles to those just above it. A surface condenser receives the exhaust steam, the water from which is taken by an ordinary pump, and drives it into the upper set of boiler-tubes through the boiler to a vaporiser placed in front of the boiler, and with which the steam pipe communicates. Although the boiler will safely work with 160 lbs. of steam, it was only found necessary to use from 120 to 125 lbs. in the race with the *Mary Powell*. The yacht has a fire-box of 6¼ ft. square. Its screw is four-blasted, 4½ ft. in diameter, and 6½ ft. pitch. The boat only draws 4½ ft. at the stern and 3 ft. at the bow. Rapid as this yacht has proved to be, she cannot be propelled as quickly as a few of the fastest torpedo boats now being built in this country. The race performance, however, which we have referred to, will probably cause the naval authorities of the other countries to direct their attention to their use in warfare.

ELECTRIC LIGHT ENGINES ON SHIPBOARD.

SEVERAL complaints have recently been made that electric light engines on shipboard do not run regularly. *The Electrician* (New York) states that on some ships this defect has caused the abandonment of the electric light. Considerable trouble has been occasioned by electric light engines being connected with and exhausting into the condensers. These latter would not do the necessary work as they were only large enough for the main engines. Although an electric light engine is small, it consumes much steam and causes much additional work by throwing this into the condenser, while the "exhaust is so rapid that it may almost be termed continuous." It varies in its action in the condenser, when the surface is already required for the main engines from intermittent action of their exhaust. The cause of irregularity is said to result from exhausting into the condenser, whereby the compression upon which the electric light engines greatly depend for their regulation is taken away, and this is alleged to be the only cause why engines of this class should not operate as well on ships as elsewhere.

EXPERIMENTS WITH OIL IN STEAMERS AT SEA.

SOME important data is now being collected by the Hydrographic Office of the United States Navy Department, respecting the various circumstances under which the use of oil is most efficatious in minimising the danger of heavy seas. When it is thought that sufficient particulars have been obtained, a publication will be issued from that office giving such directions for the use of oil as the experience of mariners may appear to be the best. According to a few cases related, in which oil has been used to avert shipwrecks, and the too limited investigations which have previously been made respecting this subject, we believe that the directions referred to will be extremely useful and appreciable.

THE ARMOUR-CLAD BENBOW.

ON page 121 will be found illustrations of the steel armour-clad barbette ship *Benbow*, the fourth launched of the six vessels of the Admiral class. Of the manner in which the Thames Iron and Shipbuilding Company have performed their part of the contract in the construction of the ship experts speak in terms of high praise, and of some of the qualifications which may be looked for in the *Benbow* as a swift carrier of heavy artillery into action, a favourable prediction may be drawn from the trials of the engines and barbette guns of the pioneer of the class, the *Collingwood*. It is with regard to the question of the sufficiency of the protective appliances employed to secure in effect a safe and manageable platform for the artillery in a sea fight that the most important differences of opinion have arisen, among both naval officers and naval architects. Between the extreme course adopted in the earlier class of iron-clads, like the *Warrior*, of protecting the whole of the ship by armour, and that adopted in the *Italia*, of simply covering the engines and magazines by a thick steel deck below the water-line, with armour only for the gun stations, pilot-tower, and communications with the magazine, there is the middle course of forming an armoured citadel. It has been sought to carry out this system of partial protection in ships of the Admiral class by placing a belt of armour at the water-line amidship, by covering the engines and magazines with shell-proof decks, by putting armoured bulkheads and screens across the ends of the citadel thus formed, in order to guard the broadside batteries against a raking fire, and by putting armoured breastworks round the big guns, the safety of the loading appliances being further secured by these fixed polygonal towers with sloping facets on the upper deck.

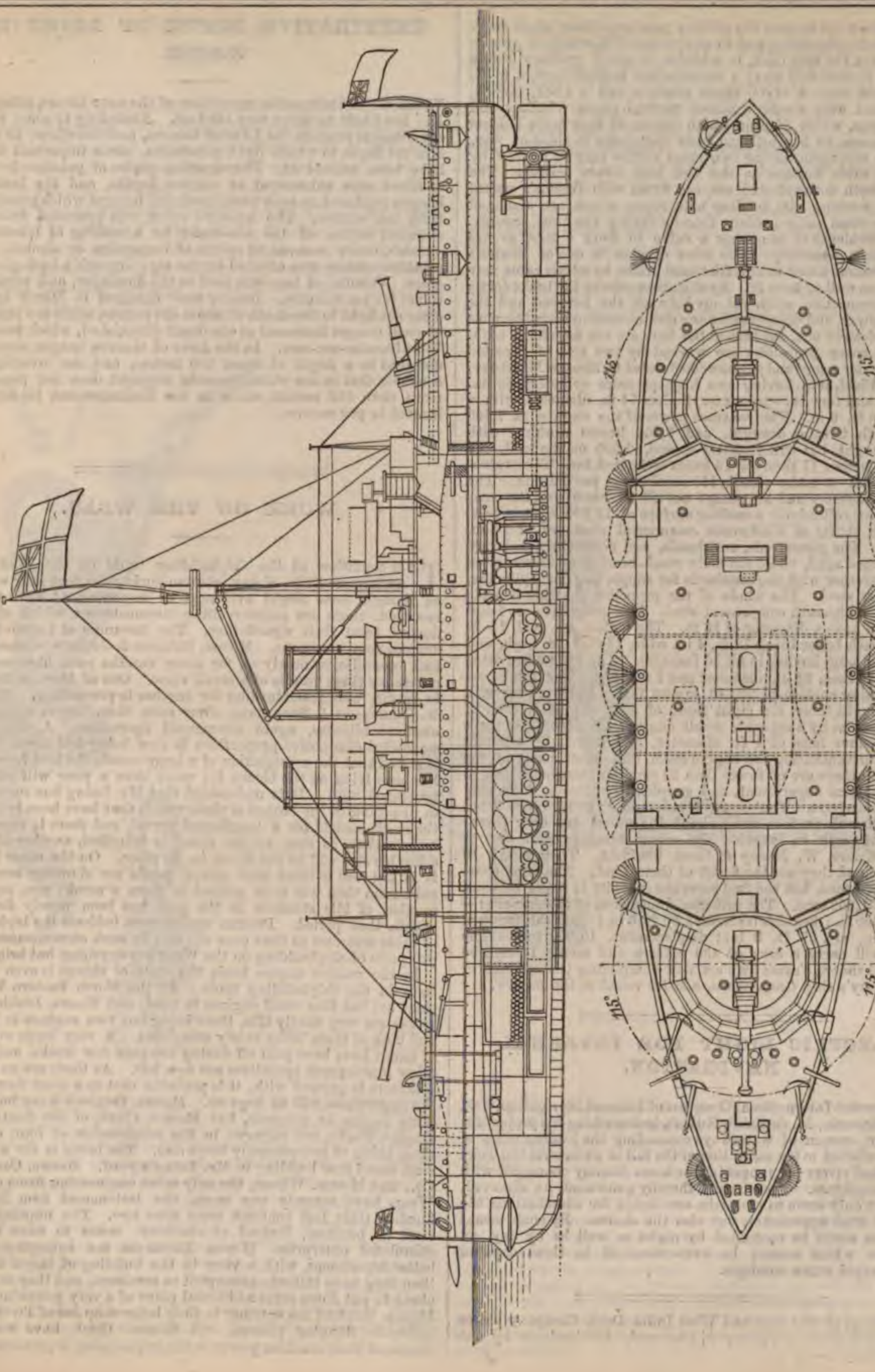
The builder of a ship, it will be remembered, cannot, like the builder of a house, increase to any extent he pleases the strength and solidity of the structure he has to produce, and, in fact, the equivalent of the total weight of water to be displaced by the vessel once decided, he must strictly apportion so much for weight of hull and armour, so much for weight of engines and coal, so much for stores and water, and so much for guns and ammunition. In the *Collingwood* the limit was set at a displacement of 9,150 tons; the figures were raised to 9,700 tons for the *Rodney* and *Howe*, and further increased to 10,000 tons for the *Camperdown*, *Anson*, and *Benbow*. Since in the apportionment of the weight to the purposes just mentioned it was decided to carry the belt of side armour at the water line along rather less than half, or only five-elevenths, of the length of the ship, provision had to be made to keep her afloat and upright and to preserve her steaming and steering powers in the event of her unarmoured ends being penetrated by shot or of the under-water parts being injured by torpedo or ram. These objects the designers have sought to secure by sub-dividing the hull both above and below the load-line into numerous, certainly not fewer than 190, water-tight and distinct compartments and cellular spaces. The double bottom is carried beyond the citadel bulkheads in both directions, but further protection is afforded against injury from below by a water-tight platform over the hold throughout the entire length of the ship, and between this and the under-water shell proof deck are the boilers, engines, and magazines of the big guns. In effect, the method of subdivision is such that from the hold right up to the main deck there are practically three skins.

Protection against shot and shell is provided for in the first place by a strip of steel-faced compound armour 18 in. thick and about 150 ft. in length, so placed as to cover the sides amidships to a depth of 5 ft. below the load-line, and to a height of 2 ft. 6 in. above the water. Over the part of the vessel so defended against horizontal fire there is also carried an armour deck, built up of two thicknesses of half-inch plating, and one layer of two inches thick, making three inches in all. At the sides and at the ends of the citadel this protective deck slopes down to meet the lower edge of the side armour, the mean depth of this deck below water being 3 ft. All the openings can be closed with sliding armour covers of the same thickness as the deck, and all are made water-tight except the hatches of the stockholds and engine rooms, these being protected by armour gratings and coffer-dams, with 3-in. glacis plating. Below this protective deck there is placed over the engines and boilers a light steel splinter deck, three-eighths of an inch thick, to prevent interference with the forced draught upon which the higher effectiveness of the steaming power depends. Across the ends of the citadel are bulkheads of 18 in. and 16 in. compound armour, and on the upper deck between the sides and the barbettes are screens 6 in. thick. The sides of the ship above the upper deck where the broadside batteries are placed are of steel 1 in. thick, so that practically the gunners there are shielded only against the fire of the smaller machine guns, and, supposing that steel of the fine quality used splinters very little, there is, with the higher penetrating power of even comparatively small modern guns, pretty nearly a return in this respect to the conditions under which our sailors went into action behind our wooden walls of old.

Further protection is obtained from the disposition of the coal bunkers along the sides of the ship, so that, when filled, they oppose a thickness of about 9 ft. of coal to the passage of shot. Between these and the outer skin of the ship are wing passages 6 ft. wide, and along the inner wall—on the outer sides of the coal bunkers, that is to say—will hang voluminous folds of thick canvas, which, if the sides were penetrated, would be pressed against the hole and so reduce the inrush of water. Coal bunkers, 21 ft. wide, are also carried across the ends of the citadel line fore and aft, and on the lower deck, in front of the horizontal water chamber (introduced to check the rolling of the ship by the movements of a large weight of water freely flowing from side to side), there are four deep water-tight tanks, of 15 ft. in length, to hold the ship's cables. The two barbettes each cover a space on the upper deck about 45 ft. in width by 60 ft. in length, the base in plan being, roughly speaking, pear-shaped, to allow room for loading the guns. They are covered with steel-faced armour of a normal thickness of 14 in. on the exposed parts, where the slope practically increases the thickness of the portion which might be struck by direct horizonal fire, and 12 in. thick in the rear. The working out of the arrangements for bringing up the huge projectiles and large masses of powder for the 110-ton guns, to be mounted in the barbettes, could not be proceeded with, of course, until the question of armament was, after some delay, decided. An armoured shaft, or ammunition trunk, as it is technically called, covered with iron plates 12 in. thick, provides for the safe lifting of the powder and shot from the magazines below to within each barbette. Sliding iron doors which shut automatically when the cage or lift is ascending or descending diminish the danger of mischief from the chances of a shell bursting within the barbette. The lift, conveniently fitted to receive at top the projectile weighing about 1,800 lb., and, in two half cases, the battering charge of 900 lb. of powder, is drawn up by a steel rope worked by specially devised hydraulic machinery, and while the gunners are loading the gun the magazine detachment below are getting the next round into position at the foot of the ammunition tube. The top of the shaft, which is a rectangle of 6 ft. 6 in. by 4 ft., is covered by an armoured hinged scuttle, and when this lid-top, as it may be called, is raised, supplies of ammunition and shot can be expeditiously lowered direct to the magazines—a matter of much importance when such heavy weights have to be dealt with. Another point worth mention is an arrangement by which the upcast draught for the ventilation of the ship passes through the barbettes so as to help to clear the interior space as quickly as possible of smoke.

For the armament of the *Benbow* two of our heaviest cannon, the 110-ton monster Armstrong guns are employed. They are disposed one in each of the isolated barbettes forward and aft the citadel, on the upper deck, and at a considerable height above the water. The broadside guns are 6-in. breechloaders, five on each side, the end guns being so mounted that they can be trained to fire through ports in the armour screen in a fore and aft line respectively. On the spar deck will be eight 6-pounder quick-firing Hotchkiss or Nordenfeldt guns, with ¾-in. shields for the crews working them, and it is still under consideration whether four similar guns shall not be placed on the upper deck. At the sides, near each corner of the spar deck, will be a covered semi-cylindrical projection or tower with a diameter of 6 ft. 6 in., fitted with ·45-in. 5-barrel Nordenfelt guns, and eight Gardner guns will be ready to be mounted on the tops of the armour screens, two for each, on the upper deck, to repel boarders with their streams of bullets. In addition to this formidable armament of guns the *Benbow* is fitted with five torpedo ports—two on either broadside and one in the stem—from which Whitehead torpedoes projected by compressed air may be discharged from the impulse tubes clear of the water. A powerful ram gives the ship, as she lies on the ways, almost ready to take the water, a very truculent appearance.

For the protection of the officers navigating the ship and the steersman there is a rectangular conning tower, covered with 14-in. armour and measuring inside 8 ft. by 5 ft. 6 in., placed at the rear of the forward barbette, where the steam steering gear and means of communication by mechanical contrivances and speaking tubes with all parts of the ship are enclosed. For propelling power reliance is placed entirely on the steam engines



H.M.S. DENBOW (*see page* 120).

working the twin screws, the solitary pole or military mast serving merely for signalling and to carry a small Nordenfelt gun in the top. On the spar deck, in addition to seven ordinary ship's boats, the *Benbow* will carry a second-class torpedo boat, a 48-ft. steam-picket boat, a 37-ft. steam pinnace, and a 42-ft. launch. She is fitted with Baxter's patent vertical steam windlass and capstan gear, which dispenses with the use of four cable holders or compressors, as has hitherto been customary in ships of war, as by this arrangement the two sheet cables may be worked by the same cable holders as the two best bower cables. The capstans, both forward and aft, are fitted with Baxter's waved wheel for working and holding wire ropes, which are arranged above the chain cable-holders, thereby saving the time, trouble, and inconvenience of removing a cable to work a rope as has hitherto been necessary. The after capstan is one of Baxter's safety capstans, fitted with a frictional brake, by which cable may be veered as well as hove in. By this arrangement the brake forms the only connection when set up between the barhead and the capstan proper, and consequently any strains coming upon the cable beyond a desired one, the men at the bars are not interfered with. The twin-screw propellers are worked by two sets of inverted three-cylinder compound engines constructed by Messrs. Maudslay, Sons, & Field, and having two high-pressure cylinders 52 in. diameter, and four low-pressure cylinders 74 in. diameter, with a stroke of 3 ft. 9 in. The contract power of the engines is 7,500 horses with natural draught, and 9,500 horses working with forced draught, but will probably exceed 10,000 on the trial, and a speed of nearer 17 than the 16 knots estimated for. The engines are expected to make about 100 revolutions per minute. The surface condensers and air pumps are all of brass, and the condensers have collectively a cooling surface of 17,000 square feet. The crank shafts of Whitworth compressed steel are of 16-in. diameter. The piston rods, crossheads, and connecting rods are also of forged steel, while the main crank-bearing and foundation frames, together with the standards for supporting the cylinders, are of cast steel. The whole of the propeller shafting is made hollow of Whitworth compressed steel. The propellers are four-bladed and have a diameter of 16 ft. The boilers are oval, 12 in number, each boiler being 12 ft. 4 in. wide, 14 ft. 1 in. high, and 9 ft. 11 in. long, having in all 36 furnaces. The boilers are fitted with 3,432 tubes, 2¾ in. diameter and 7 ft. long. The total area of the heating surface is 20,440 square feet. For working with forced draught there are eight fans, of 5 ft. diameter, each of which is driven by a separate small engine. Besides these there are four other fans, of 4 ft. diameter, also driven by separate engines, for ventilating the engine room and other parts of the ship. In all there are no fewer than 32 small engines belonging to the main engine department, and supplied by Messrs. Maudslay under the contract. The copper steam and exhaust pipes fitted to the different engines throughout the vessel are over three-quarters of a mile in length. The screw brackets were cast in steel by Messrs. W. Jessop & Sons, Sheffield. They weigh 10 tons each, and they are the finest of their kind. The coal complement 900 tons, but the fuel carrying capacity is really between 1,100 and 1,200 tons. The principal dimensions of the ship are:—Length, 300 ft.; breadth (extreme), 68 ft. 6 in.; draught, forward 26 ft. 3 in., aft. 27 ft. 3 in.; displacement, 10,050 tons. The *Benbow* will carry a crew of 430 officers and men. It may be mentioned that the same firm are now completing the engines of Her Majesty's ship *Camperdown*, a sister vessel to the *Benbow*.

ELECTRIC LIGHT FOR INTERNAL NAVIGATION.

AT the recent International Congress of Internal Navigation, held at Brussels, M. de Saint-Hubert, in describing his project for an uniform system of waterways connecting the leading cities of Europe, referred to the utilisation of the fall of water over the weirs in canalised rivers for propelling turbines directly connected with dynamo-machines. The current thereby generated, he observed, would not only serve to maintain arc lights for illuminating the lochs and other approaches, but also the shores. By such means navigation could be continued by night as well as by day, an advantage which cannot be over-estimated in these days of required rapid water carriage.

THE report of the East and West India Dock Company states that the new docks at Tilbury will be ready for business by the 1st of January next.

PENETRATIVE DEPTH OF LIGHT IN WATER.

FOR several submarine operations of the near future, solar rays are likely to prove very efficient. According to some recent experiments made in the Lake of Geneva, and elsewhere, to ascertain the depth to which light penetrates, some important results have been arrived at. Photographic plates of gelatine-bromide of silver were submerged at various depths, and the luminous images produced on such were developed by rays which penetrated from the surface. The sensitive cover was protected from the chemical action of the sea-water by a coating of bituminous varnish, easily removed by spirits of turpentine or alcohol. The sensitive surface was affected by the rays through a back-plate of glass. Oxalite of iron was used as the developer, and permitted to act for ten minutes. Images were obtained in March last in clear sunlight to the depth of about 400 metres, while the strength of such images increased as the depth diminished, which was near Ville-franche-sur-mer. In the Lake of Geneva images were only obtained to a depth of about 200 metres, and the investigators conclude that in the winter months sunlight does not penetrate more than 200 metres, while in the Mediterranean its depth is limited to 400 metres.

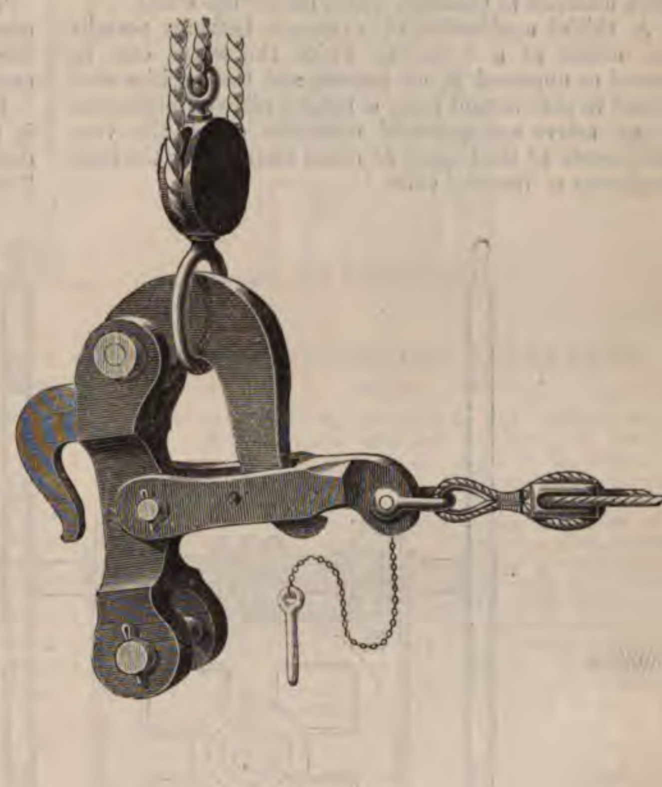
WORK ON THE WEAR.

THE condition of the shipbuilding trade on the Wear has undergone little, if any, change during the past four weeks, as though some slight evidences of improvement have to be recorded, there are countervailing circumstances which greatly detract from their significance. The instances of improvement are not very numerous. Messrs. Osborne & Graham, whose yard had been idle, or nearly so, for many months past, have secured orders for three vessels of a small class. One of these is already in frame, and frameturning for another is proceeding. Messrs. R. Thompson & Sons have, after more than twelve months of absolute idleness, again commenced operations. A vessel of somewhat diminutive proportions is now being laid down, but it is stated that the construction of a large vessel, the keel for which has been lying on the blocks for more than a year will also be proceeded with. It is understood that Mr. Laing has succeeded in disposing of the largest of three vessels that have been lying on the stocks unsold for a lengthened period, and there is reason to believe that, as soon as the vessel is launched, another of considerable size will be put down in its place. On the other hand, it is but too evident that several yards are showing even less animation than was to be noticed in them a month ago, and the number of idle steamers in the port has been nearly doubled within that period. Present appearances indicate the laying up of other steamers as time goes on, and in such circumstances the prospects of shipbuilding on the Wear are anything but bright.

In the marine engine trade the state of things is even worse than in the shipbuilding trade. At the North Eastern Works there are but four small engines in hand, and Messrs. Dickinson's works are very nearly idle, there being but two engines in hand, and both of them being nearly completed. A very large number of hands have been paid off during the past few weeks, and only a few journeymen operatives are now left. As there are no other contracts to proceed with, it is probable that in a short time only the apprentices will be kept on. Messrs. Doxford have but one large engine in progress, but Messrs. Clark, of the Southwick Engine Works, are engaged in the construction of four, one of them being of exceptionally large size. The latter is for a large steel vessel now building in Mr. Laing's yard. Messrs. Carr and Co., and Messrs. Wilson, the only other engineering firms on the Wear, have scarcely any work, the last-named firm having finished their last contract some time ago. The unprosperous state of business, instead of checking, seems to have rather stimulated enterprise. Messrs. Dickinson are enlarging their boiler department, with a view to the building of larger boilers than they have hitherto attempted to construct, and they are also about to put down some additional plant of a very powerful type. Messrs. Doxford are erecting in their boiler shop one of Tweddell's hydraulic flanging presses, and Messrs. Clark have recently increased their machine power in the engineering department.

THE REES PATENT BOAT DETACHING HOOKS.

THERE have been, from time to time, already illustrated and described in our journal many forms of automatic boat-detaching gear, some better than others, and some so complicated and delicate in their action as to be impracticable in ordinary use on the face of them. We illustrate this month Rees' Patent disengaging and hooking-on hooks for ships' boats, which is being placed upon the market by Messrs. William Reid & Co., of New London Street, E.C., and which has certainly the merit of being the simplest and cheapest appliance that has been put forward for the purpose. These hooks can be fixed to the ordinary fittings of boats without the slightest alteration, this in itself being a great practical recommendation. One figure shows the hook in position as it would be with the boat suspended from it, the other figure shows the hook released and the boat consequently free from the falls. The action of the hook is very simple and obvious from the diagrams. The hook by which the boat is suspended from an eye to the end of the ordinary falls, is pivoted, and locked in place by the horizontal slotted link, to which a light line is attached, running fore and aft of the boat, uniting the two horizontal links together. So long as the horizontal links maintain their position the suspended hook is secured, and the boat cannot be disengaged. The hooks can be locked in this position, and the hooks thus secured, by the safety pins shown in the diagrams, which are inserted when the fall tackle is not in use. The release of the weight of the boat when water borne will allow the upper suspending hook to fall slightly, thus releasing the horizontal slotted link, and, consequently, disengaging the boat from the fall tackle. The apparatus is thus automatic in its action so soon as the weight of the boat is water borne But to prevent one hook being released before the other, the man in charge can prevent the release of the boat so long as he keeps a strain on the light line connecting the two hooks. On release of this line, both hooks are released instantly and simultaneously. The hooks having fixed hooks at the back of the shank, the hooking on and getting the boat quickly out of the water is greatly facilitated in stormy weather, but there is no difficulty in applying the disengaging hook in ordinary fair weather.



SIR E. J. REED, M.P., speaking before the Cardiff Chamber of Commerce last month, said the proposal of the Admiralty was to establish a reserve of stokers and engine-room artificers, whose services would be available in war times. About 2,000 stokers and 200 engine-room artificers were the numbers contemplated. It was not proposed for the present to call out the men for drill, as only efficient men would be enrolled, but that a capitation grant should be paid to each man in consideration of his undertaking to hold himself at the disposal of the Government in the event of war being proclaimed.

DAVIS'S STEERING GEAR.

AMONGST the many and various systems of hand and steam steering gear exhibited at the Inventories, perhaps there are none which will more thoroughly commend themselves to the favour of engineers and nautical men generally than that of Messrs. Davis & Co., of Garford-street, West India Dock-road, London, and of which illustrations are given below and on page 125.

The hand-steering gear, in particular, we can commend to the notice of those who require that which all hand-steering machines should possess, and that is great power with a remarkable amount of speed. This machine, simple in appearance, and powerful looking, will not belie its looks. It consists of two plain-grooved barrel on each side of a worm wheel, and wide enough to accommodate an inch chain.

This barrel is driven by that most powerful of all mechanical contrivances, in the shape of a worm of easy pitch attached to the shaft which carries the wheel.

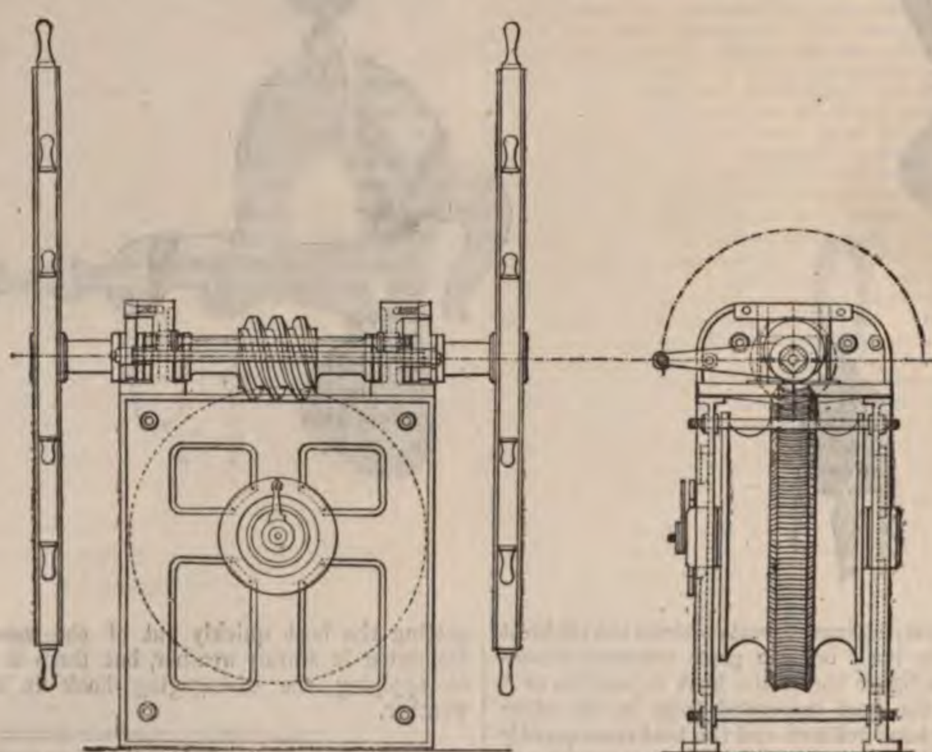
A skilful application of excentric bearings permits the action of a lever, by which the worm can be geared or ungeared in an instant, and the machine converted in that instant from a passive piece of mechanism to an active and powerful controller of all the vital movements of the largest of ocean steamers, or the most ponderous of ironclad ships.

most desirable quality—it must always be secondary to power, without which the most elaborate machinery in the world might as well be left in the shop for all the good that it can be to the ship.

In smooth water, even when these large vessels are running at high speed, hand steering is easy enough with any kind of gear, and can generally be mastered by one seaman of average strength; but in going in and out of port, in passing through narrow channels, where much helm is required, the difficulties then begin. When the sea, from the effects of the most moderate of winds, sets up just a little lumpy, hand steering also becomes not only difficult and dangerous, but frequently an impossibility. The troubles and annoyances which seamen call "kicking" then come into play with powerful effect, and as frequently break arms and disjoint legs, as do other kinds of damage involved in being thrown over a large wheel with the force of a stone out of a sling. Such troubles and dangers Messrs. Davis & Co.'s worm and screw gear should in great measure, if not completely, rid us of.

The steam gear of this firm, like many others, is a combination of hand and steam, although differing to others in having the advantages which have already been enumerated in favour of the worm and wheel.

In too many of the combination machines of the day it appears to have been considered enough by the designers if the steam gear was effective and reliable. The hand gear was just thrown in, so to speak, to barely



In the steering of heavy and deep draughted ships by hand the great difficulty has always been hitherto the want of sufficient power, which, in innumerable instances, has by engineers and manufacturers been sacrificed in favour of speed. But the fact is that in this kind of steering—although speed, in giving the ship helm, is a

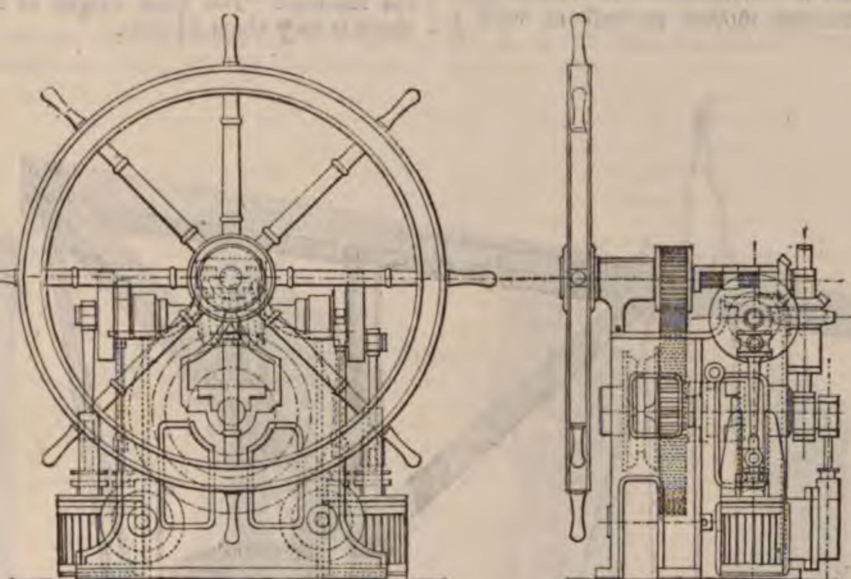
accomplish a fact, and when this same hand gear was put to the test it was invariably found next to useless from want of power.

Some may think that as long as a ship has a good steam machine she cannot go far wrong; but those who have to pay for the wear and tear of steering chains and

leading blocks through which heavy chains travel are of a different opinion. In a large fleet of steamers the expenses of new chains and repairs to old are an item which few can afford to ignore. The constant see-sawing which steam steering brings upon chains soon wears them out, and wears them down to such an extent that cautious managers cannot afford to trust to them

The only thing that Davis's hand gear appears to want is a good foot break for hard weather, and although experience with the worm system may perhaps not demand it, a few trials will settle that point.

All steam gear ought to be covered in with a light metal covering to keep out dirt, foreign substances, and for protection to the helmsman



acting and holding in an emergency that comes like a thief in the night—when unexpected. And the greatest trials of this kind occur in the navigation of crowded channels, in swift-running rivers. The rule is, in all large companies, in fine open weather, to use the hand gear, as much to economise material as to keep that gear in working order; and a hand gear that can be depended on in any kind of weather, save a heavy gale and high sea, is the gear that must ultimately come to the front. It not only steers the ship steadier than steam, but exerts so much less stress upon blocks and chains. Another very important point in these combination machines is the clutch, which connects or disconnects the hand from the steam. The clutch lever should be long enough to actuate readily, which is not always the case, from a want of leverage in *starting* the clutch, and in such a position that it can be handily worked.

Davis's appears to us to have these conditions. Another good feature in his hand gear, is in having the ends of the chain secured firmly to pins passing through the main barrel. In this way, as one chain comes in the other goes out, exactly at the same rate, and is thus clear of the liability to kink and jamb, which has been the cause of so many serious accidents. By this method there can be no jumping of the slack chain over the gipsey barrel, which has led to so much trouble, that many firms are doing away with the gipsey at great extra cost. It generally, or frequently, jumps in putting the helm hard over to clear a ship, and, of course, just at that time it should not. Even when there is no slack chain this has occurred, perhaps on account of the sharp corners and edges being worn off the gipsey.

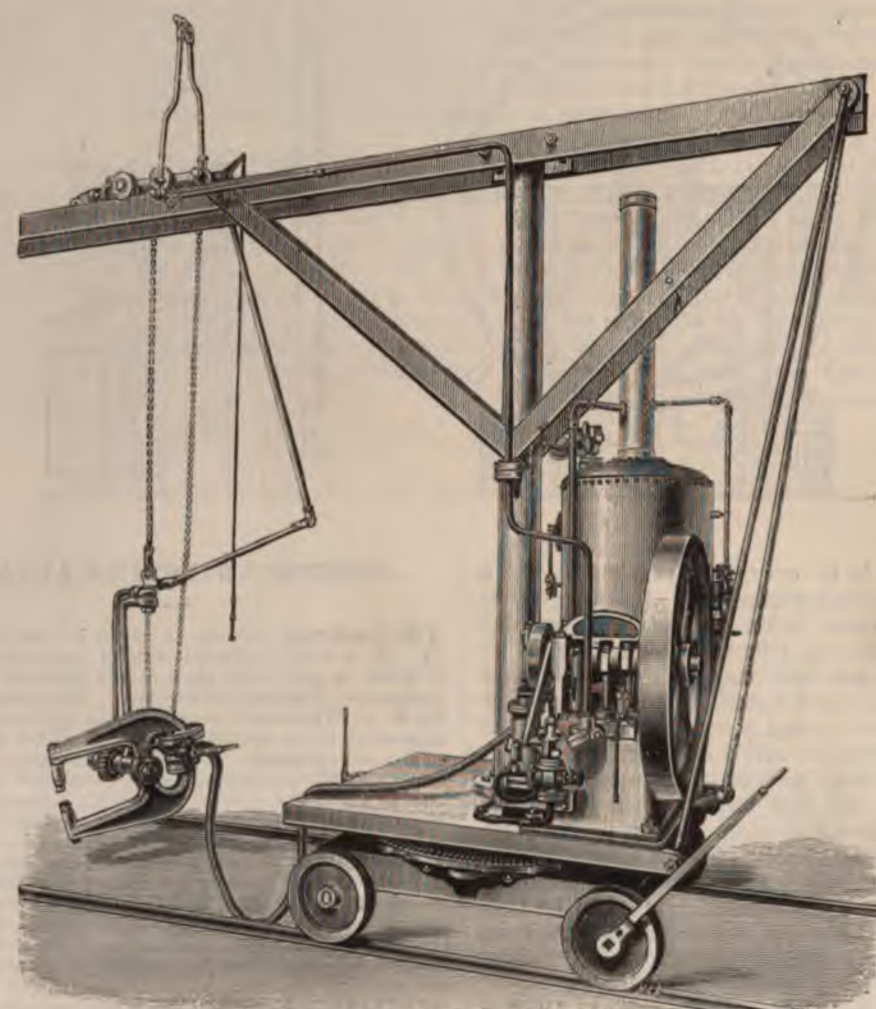
ELECTRIC STEERING APPARATUS.

An interesting account is given by the *American Engineer* of a newly invented steering apparatus, an exhibition of which recently took place at the works of the Clayton Air Compression Company, at Brooklyn. This machine, invented by Mr. C. H. Washburne, consists of the application of compressed air worked by an electrical apparatus to the movement of the rudder and the steering of the ship. The essence of the invention consists in the combination of a compressed air supply and a moving piston in a cylinder and directly operating upon the tiller wheel chains. The supply of air to the cylinder is regulated by a rotary valve of special construction. This valve is arranged to be worked by an auxiliary cylinder and valve, controlled by electric magnets actuated by a current governed by the movement of a mariner's compass needle. A delicately operating mechanism is connected with the compass and communicates by wires with the magnets. The apparatus may be so set that when the ship deviates from her course the needle of the compass comes into contact with the electrical mechanism, whereby a current is transmitted to a pair of magnets which work a valve motion opening or closing the air supply to the rudder's cylinder, and the rudder is worked and the ship brought round to its course. Two other methods of using or regulating the steering gear are provided, independent of this automatic electric compass connection. One of these is on the bridge and consists of a small lever which, on being pushed one way or the other, opens electrical connection which, by affecting the magnets, causes the rudder to move to port or starboard. A second system is by a wheel in the wheel-house, which works the electrical instrument and thence the rudder. The apparatus which is simple in construction and apparently quite durable, takes up but little space. A thorough trial will be made of the machine in the United States steamer *Dispatch*, when, if it proves satisfactory, it is thought that it will be generally adopted.

The French Minister of Marine estimates that the cost of the repairs to the equipment of the Navy will exceed 30,000,000 frs.

PORTABLE HYDRAULIC RIVETTING PLANT ON THE DIRECT SYSTEM.

THE wood cut below represents a Portable Hydraulic Rivetting Plant, worked on the "Direct System" as patented by Messrs. Higginson & Co., Limited, Mersey Street, Liverpool, which for bridge erection and shipbuilding purposes is unsurpassed. It is fitted with radiating and traversing motion as well as with a rupting the circuit by bringing the machine into operation, the momentum of the fly-wheel instantaneously and effectively closes the rivet. By a suitable relief valve the pressure can be varied in each machine, a matter of importance, especially in rivetting plant. By a simple arrangement they dispense with the use of an accumulator, finding an ample reservoir of power in the fly-wheel of their special hydraulic pumps, which from the fact of the work being intermittent, stores ample force to work the machine. The total weight of a plant as shown above is only about $5\frac{1}{2}$ tons.



hydraulic lift for lifting and lowering the rivetter. The rivetter (as shown), is what is known as the Jaw type, and is made of the best cast steel, fitted with gun metal cylinder. On the "Direct System" the water is always in motion, flowing from the pumps through the lift and rivetter, and back again to the pumps, thus keeping up a continual circulation. When the machines are not being used the pumps utilise only the power necessary to circulate the water through the connecting pipes at the small pressure due to friction. On inter-

THE *Daily News* says:—An interesting fact is made known in connection with the torpedo boats which Sir Michael Hicks-Beach, to his indignant amazement, discovered had no torpedo gear. At the time when relations with Russia were strained almost to the point of war, there was much discussion as to whether the British fleet would be permitted to enter the Black Sea. No indication of intention was given by her Majesty's Government. We learn, as a matter of fact, that whilst this discussion was going forward in the foreign Press, arrangements were completed for the British fleet to enter the Black Sea. These boats, to which Sir Michael Hicks-Beach referred, were specially built for this expedition, and were intended to be used, not as torpedoes, but as defences protecting the British fleet from the torpedo of the enemy.

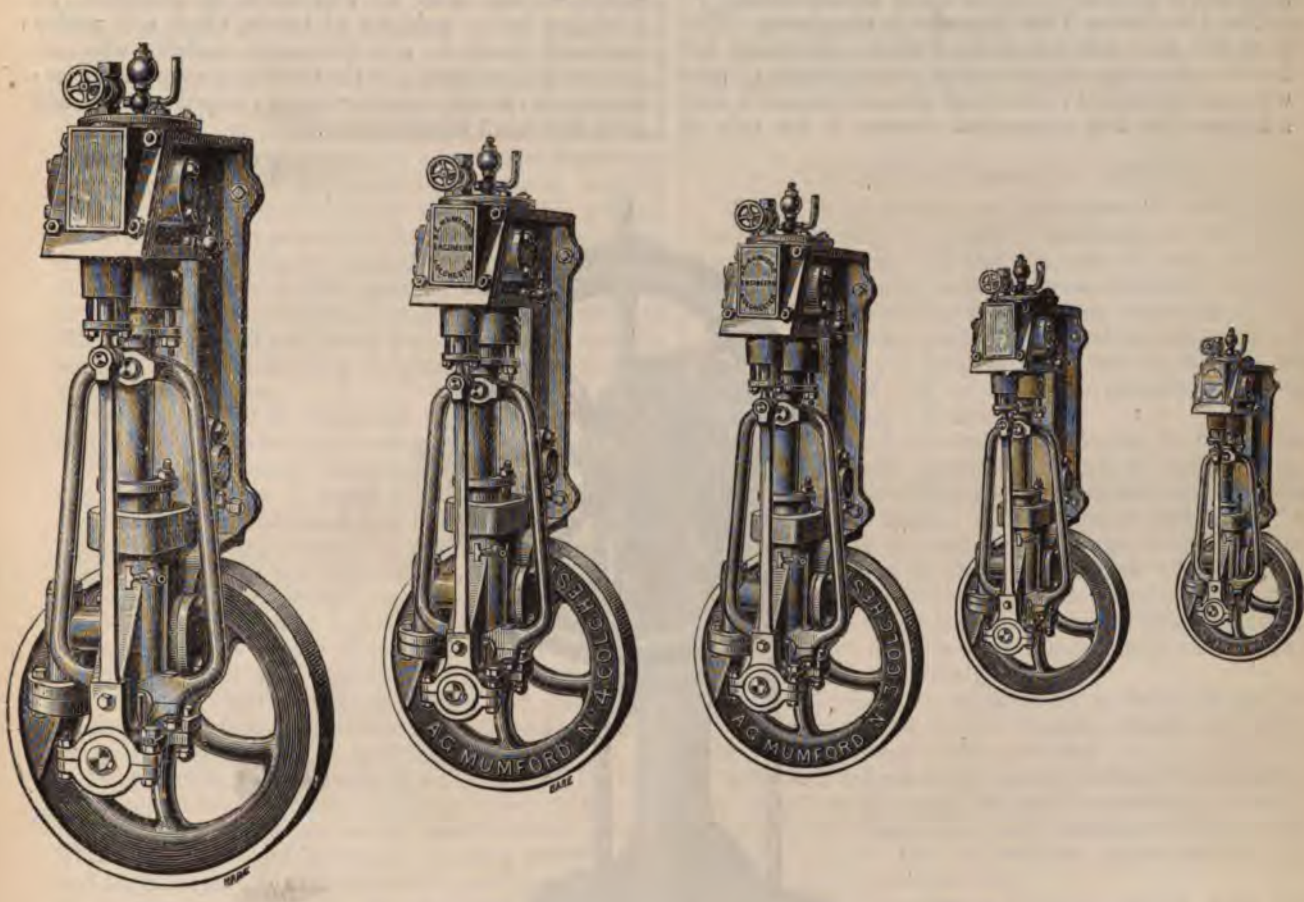
International Inventions Exhibition.

(*Continued from page* 72.)

MUMFORD'S DONKEY PUMPS.

Mr. A. G. Mumford, of Colchester, has a number of his Donkey Pumps on view, of two descriptions. constructed with a crank working in a slotted crosshead; it can be fixed either horizontally or vertically, the valves being made to take the proper position by turning them in their sockets. They have been specially designed for launches and small steam vessels, when they have to be frequently placed in very cramped positions. We note that Mr. Mumford sells a small size, specially suited for small steam launches, with the steam cylinder and pump made of gun metal.

These pumps can also be seen at the show-room of Mr. J. C. R. Okes, 39, Queen Victoria Street, London, E.C.



The "Favourite" type being vertical, and suitable for bolting to a wall, bulkhead, or the side of the boiler; the pumps are well designed; they are machined and put together in a workmanlike manner; we can speak from practical experience, extending over some years, as to their satisfactory working. As will be seen from the illustration, the crank shaft is machined all over, it is carried in double bearings below the pump, with the flywheel at the back, and the slide excentric in front; the connecting rod is heart shaped, spanning the pump on either side, so that all strains are kept in one plane. The rams, glands, and bearings are of gun metal. The exhaust, suction and delivery can be attached to either side, as may be most convenient, the steam inlet being on the top. The framing of the engine forms a large air vessel.

The "Desideratum" pump is neatly designed, and is

BOAZ'S PATENT TUBE STOPPER, TUBE SCRAPER, AND TUBE EXPANDER.

A small but interesting exhibit is made by Mr. W. Boaz. First and foremost is his well-known and appreciated tube stopper, which by this time is probably better known practically by our readers than by ourselves, so needs no further description here.

He has recently brought out a tube-scraper, which we illustrate in the accompanying cut. It consists of a steel or iron casting, having two semi-circular scrapers, placed a few inches apart, opposite each other, and connected by suitably shaped webs. The two semi-circles form the complete circle of the tube; the scraper is used so that the weight of the handle keeps them in contact with the sides of the tube, and, of course, gives a constant pressure independently of any spring arrangement, and unaffected

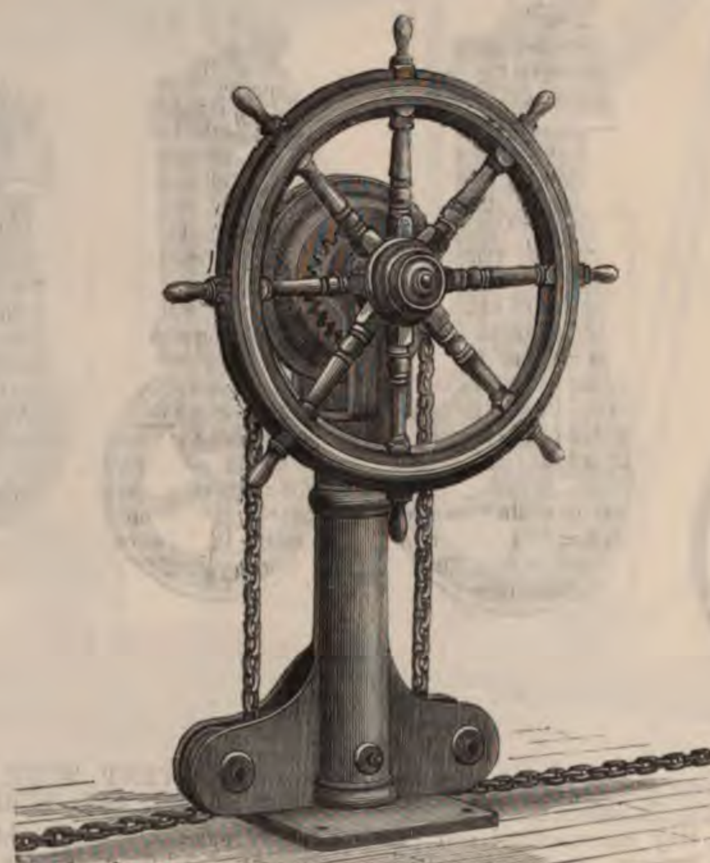
by wear. The scraper does not block up the tube, so that it is not liable to get choked, and the draft carries away the soot, &c., as it is removed. The handle is placed all on one side of the scraper rod, so that the man using it is not so liable to get the skin knocked off his knuckles by the edges of the smoke-door frames. An improved arrangement is also shown consisting of a telescopic handle to be used in place of a jointed rod. The inner bar is screwed on opposite sides for about half its circumference, the other halves being reduced so that a lock nut which fixes the relative positions of the rods when screwed up, if turned one-quarter round, allows the inner rod to slide freely into or out of the outer rod.

The Allix Patent Tube Expander is also shown. This is on the same principle as the Dudgeon Expander, but has the advantage of covering a greater range of sizes with one instrument; also, small pins are inserted in such a manner that they engage into recesses in the ends of the rollers, which, though free to move radially within the desired limits, cannot fall out of their place, so that they are not likely to be lost, or to cause loss of time and temper when the expander is being used.

Mr. Boaz also exhibits a new form of screw propeller, which cannot be properly explained without illustrations, but is designed with the view of preventing the centrifugal force causing the water to fly from it radially, and forcing it to assume a motion directly astern. Of course, numerous propellers have been brought out claiming this advantage, with results sometimes better, sometimes worse. In Mr. Boaz's screw the periphery is in advance of the body of the blade, and from its peculiar shape (somewhat in the form of a shallow spoon) is intended to give the water sufficient centripetal force to prevent its spreading itself radially. The propeller is stated to have given improved results when tested against others, and we shall be pleased to give further particulars when they are available.

ARCHER'S SELF-HOLDING STEERING GEAR.

Archer's Patent Self-holding Steering Gear, of which we here give an illustration, is, doubtless, an invention for the economy of labour, which will readily commend itself to our numerous readers, who are interested in yachting; in the steering of steam launches; steam tugs; steam, or sailing barges; torpedo craft of any kind, and small vessels generally.



A steering gear of this kind will be a great assistance to all vessels ranging under 300 tons, and, possibly, to many over that tonnage. For yachts and fishing boats and for barges in particular, it will not, possibly, be long before it entirely supersedes the cumbrous and old fashioned tillers, with its necessary lanyards and long pull of weather helm. In all previous forms of wheel steering gear, there has been an objection, on the part of yachtsmen and fishermen, to the rattling chain, and to the inability to "becket" the wheel when occasion demands, as can be done with the tiller; but this "self-

holding" apparatus may possibly open the door to the general adoption of the wheel system in all such vessels which never carry too many hands, and can always find something for the helmsman to do in such trifling but important matters of letting go a guy, or taking a turn with a rope. A few fathoms of the boom sheet hauled in, the running up of an ensign, or the shifting of a ladies' chair, are all little matters which could be done, and would gladly be undertaken by any jack tar who could keep his vessel on her course, without that perpetual grinding of water, and constant see-sawing; if only he had a wheel or a tiller in his hand, which would stand still when let go. The becketing of the tiller, or the taking of a hitch with a lanyard are all little matters which, though not occupying many minutes for a man with nimble fingers, still takes up that amount of time in seconds which has frequently carried away a boom, or gone far in the losing of a race. It will be observed from our illustration that Messrs. Archer's system consists of an exceedingly neat and singularly small framework of cast metal, carrying upon or in connection with the wheel spindle, a chain sheave, over and upon which the steering chain passes, in the ordinary parbuckle method. This chain sheave is fitted with internal toothed gearing, which is connected to an excentric pinion wheel attached to the spindle, and from which motion and power is communicated from the steering wheel to the chain, running through sheaves to the end of the tiller.

Power is gained in proportion to the number of teeth which the larger wheel may have over the lesser.

Perhaps the greatest advantage out of the many in this system is, that it is self-holding, and permits the yachtsman or the fisherman—let him be amateur or professional—in letting go his hold during the many occasions when winds are light and water smooth. To gentlemen sailing their own yachts, or even to the busy bargeman and his good lady, floating together placidly down the waters of the Thames, this is an advantage which they will well appreciate, for it so frequently happens, under such conditions of wind and water, that although there is so very little steering to be done, yet to let go the tiller would be to spoil that fine steerage.

Many yachts, whose steerage is well balanced by their sails, will, in smooth water, run along for ten minutes at a stretch, if the helm can be held steady in that position which has been found favourable for such performance; and the same may be said of steamers, and small steamers in particular, with very fine and sharp lines. To experienced yachtsmen such advantages are manifest, without further comment.

Also, in such cases as what is known to seamen as "kicking," caused by a fresh wind suddenly falling away and leaving more or less ripple of water, this "self-holder" will strongly commend its benefits to that captain or steersman who has, at other wheels or tillers, experienced the refreshing and far from uncommon evolution of being pitched, headforemost, against the lee bulwarks. It is claimed for Archer's system, that the rudder can only be worked by the helmsman himself moving the wheel, which can be done readily, at will. The gear is very simple in construction, and is said to be as quick as thought, in action. Another considerable recommendation it has, and that is, that it is cheap, and costs no more than any other kind in general use. This gear is said to be largely in use by the Tyne General Ferry Company, the River Tyne Commissioners, Sir William Armstrong, Mitchell & Co., and other firms on the Tyne and the Clyde.

With this steering gear is also exhibited at the Inventories, Archer's Compressor, or Nippers, for holding wire hawsers. The nipper consists of a frame in which are loosely hinged two grooved jaws of sufficient length to grip the steel hawsers. These jaws are opened or closed by means of a lever worked by a handle. During the downward motion of the jaws, the pressure gradually increases, and finally becomes infinite as they approach in a straight line. The hawsers can, in this way, be held with certainty, and if necessary it can be gradually slacked away without damaging the strands; or it can be suddenly released without the least possibility of being wedged or jambed. We learn that over two thousand of these nippers are at present in use.

TYZACK'S WELDLESS ANCHOR.

THERE is no article, nor any piece of furniture on board of a ship, of greater importance to her safety than her anchors. In the channels of swift running rivers on all ordinary occasions, or, as sometimes happens, to powerful steamers as well as to sailing ships on the desolate and rocky coasts of a lee shore, the anchor is still, and will be, as long as ships float on the sea, the curious piece of iron to which the mundane hopes of thousands of men will cling.

Ships propelled by wind and sails may be dying out, but they are still numerous enough to compel ship-owners and underwriters to devote earnest consideration for all ground tackle. The captains and crews of steamers may be inclined to trust much to their engines in the riding out of storms, but those who have the responsibilities of fitting out our merchant or naval fleets will not forget that the anchor is still, as of yore, the foundation of their safety, upon which, on so many occasions, they must solely rely.

In this direction, the great storm at Balaclava and its disastrous results for British shipping—steam and sail—will not have escaped their memories.

With such reflections, in walking through the corridors for Naval Architecture at the Inventories (Group 7, Class 40), we notice with lively satisfaction an anchor which is said to have no welding in its manufacture, and one also which stows itself.

This is Tyzack's Patent Weldless Anchor, from the well-known manufacturers of anchors in the North of England.

The man, or company of men, who lay themselves out for the manufacture of ships' anchors or ground tackle of any kind, take upon themselves responsibilities as serious as any which enter into commerce, or in the construction of great mechanical works, upon whose safety, thousands of human lives, and millions of money depend for safety. It is of greater importance than laying the foundations of a house, for, when the latter are faulty, they give timely warning of such; whereas, in the former case, it may happen that no indications of danger are observed till the anchor has given way and the ship is *in extremis*.

There have been so many accidents with anchors which have failed to have proper biting powers, or, when gripping the ground properly, have given way at certain flaws in welding, that it is somewhat refreshing to hear

of one which is perfect in such desirable qualities, and which is made without a weld in the enormous labour of forging.

Tyzack's anchor appears to come under this desirable head, and, as its name implies, is a perfectly weldless mass of iron. This important feature in its construction, will doubtless bring it into general favour in the shipping world, and conspicuously before the authorities at the Admiralty, who are entrusted with the testing of anchors.

For many years past, since the first introduction of steamers with fine lines, anchors have been manufactured much lighter than proper considerations of safety would always warrant. The idea may have been to relieve the non-water-borne section of the ship of all super-incumbent weight. But, whatever may have been the idea, manufacturers have gone too far in this direction, and too much reliance has been placed in the engines, when it should have been given to ground tackle. In this too eager desire for economy of material, there has been an inability to stand the test—not, perhaps, such as official inspection may have been *forced* to concede, but to those much more drastic ones which the natural elements of wind and sea so frequently demand.

Thus, all who are interested in shipping and its safety against storms and tempests, should, in this connection, welcome that which comes from a manufacturer of eminence, and which has been found, by reliable testing, to be not only light, but strong—that which has doubtless had all the metal put in the right place, the heart and arms, rather than other useless extremities.

The anchor under discussion is not, of course, the only one which has undergone these improvements, but it is the first, as far as we are aware, which, along with such, embodies self-stowing capabilities. There are no heavy cat or fish davits required, and no falls to replace at the end of a voyage, nor when replaced, to carry away, or in various ways, excite the apprehensions of those who are working such heavy masses of iron. In its method of self-stowing, the anchor is drawn right up the hawse pipe, and leaves nothing but the flukes outside, which are said to rest securely in an aperture, if we mistake not, slightly enlarged for their reception. Those commanders who have used this weldless, stockless anchor, speak of it in terms of high praise; and one in particular, the captain of the s.s. *Albano*, in crossing the Atlantic during last spring, had his anchor crane carried away by a heavy sea, but having one of Tyzack's new stockless anchors, the loss of the crane occasioned him no trouble.

Another who has used it, certifies that it "goes to the bottom quickly," meaning, perhaps, to say, that it becomes detached from its resting place readily, when required to let go; and that it holds, powerfully. From its construction and appearance, there is every reason to suppose that it will do all this.

It will be found a wonderfully handy anchor in entering and passing out of those docks where anchors must be taken in before entering, and put out previous to leaving, for in the working of warps, the crew always have enough to do in handling the ship, rather than in using the capstan for getting in and out heavy anchors, just at the moment of entering or leaving the docks, when above all other occasions, there is neither time nor men to spare.

In answer to Captain Aylmer, the First Lord has stated that the forty torpedo boats now being built will cost from £10,000 to £12,000 each without gear.

THE HISTORY OF PADDLE-WHEEL STEAM NAVIGATION.*

(*Continued from page* 104.)

By Mr. Henry Sandham, of London.

The following tabulated statement of particulars of early and contemporaneous ocean-going paddle steamers may be interesting:—

Vessels' Names.	Tonnage.	H.P.	Tonnage per H.P.	Remarks.
Acadia	1200	440	2¾ tons	Very swift ship.
Oriental	1670	440	4 tons	Speed 10½ knots per hour, when deep.
Great Western	1340	450	3 tons	Speed 12¾ knots per hour.
Great Liverpool	1543	464	3⅓ tons	
British Queen ..	2016	500	4 tons	Fast ship when light.
President	2366	540	4½ tons	Slow vessel always.
Liverpool	1150	404	2⅔ tons	Slow ship, and crank.

The *Acadia* was built and engined at Glasgow in 1839-40, as before stated. The *British Queen* was built at London in 1838 by Curling & Young; 275 ft. by 39½ ft. by 27½ ft., lever engines by R. Napier of 420 N.H.P., cylinders 77¾ in. diameter, stroke 7 ft.; Hall's surface condenser was used. The *Liverpool* was afterwards widened by 7 ft., making her 393 tons larger; the proportion of power to tonnage by the alteration was decreased, but the ship's speed and weatherly qualities were found to be increased.

The establishment of the Cunard line in 1839 was followed by the rapid formation of other large steam navigation companies:—

1840.—Royal Mail, West India Co.
1837-1841.—Peninsular and Oriental Co.
1843.—Pacific Mail Co. (West India and Pacific Co.)
1850.—Collins line of American vessels.
1850.—Inman Line.
1851.—African Mail Co.
1854.—Allan Line; sailing ships 1823.

These celebrated companies, especially the Royal Mail and the Peninsular and Oriental, owned for the most part steamers of great size and power, of which it is impossible here to mention all. The Royal Mail Co.'s steamers were named after British rivers, the *Tay*, *Teviot*, *Shannon*, *Thames*, and so on. Their sailing port was Southampton. They have generally been considered as the typical fleet of paddle-wheel ocean steamers of their time. They were built in 1841-47; ranged from 1,300 to 1,880 tons; and were engined by Maudslay & Field, Ravenhill, Acraman, Caird and Co., Bury & Co., Scott & Sinclair, with an average of 450 N.H.P. In 1860, the Royal Mail Co. possessed a fleet of 25 vessels, of 47,000 aggregate tonnage, and 12,230 H.P. The Peninsular and Oriental fleet, in 1860 comprised a total of 55 vessels, of 75,000 aggregate tonnage, and 18,151 H.P. At that date the *Massilia*, 1,919 tons, 310 ft. by 36 ft., and 400 N.H.P., was built by Samuda Brothers.

The possibility of providing too much engine power in steamships was clearly demonstrated by the paddle-wheel vessels *Valetta* and *Delta*, of the Peninsular and Oriental fleet. The *Delta*, iron-built 1859, by the Thames Ironworks Co, 1,953 tons, 350 ft. by 35½ ft. by 24½ ft., was furnished with Penn & Sons' oscillating engines of 400 N.H.P., taken, without any alteration, from her senior, the *Valetta*, of 983 tons; steam was provided by Lamb and Summers' boilers. The *Valetta*, with 100 tons of coal on board, had a speed of 14 knots per hour; the *Delta*, with 400 tons of coal on board, realised 14¾ knots per hour, although her capacities were more than double those of the *Valetta*. The *Valetta* was re-furnished with smaller engines, of about 250 N.H.P.; after which she steamed as well as ever. The *Ruby* Gravesend packet in first instance was also over-engined; smaller engines were afterwards substituted, with the result of an increase in speed.

Iron Steamers.—The celebrated large steamers hitherto dealt with were built of wood. The increasing price and consumption of wood for shipbuilding now compelled attention to iron. The late Sir William Fairbairn was the staunch advocate of the application of iron to shipbuilding.

The earliest mention found of an iron steamer is of the *Aaron Manby*, built, in 1820, at the Horseley Ironworks, Tipton, and named after her designer and constructor. The hull was sent in pieces to the Thames, put together in the Surrey Docks, and she went a voyage to Paris, landing there a cargo of rape seed at the Pont Royal over the Seine. Sir Charles Napier navigated the vessel, her machinery being in charge of the late Mr. Charles

*Read at a Meeting of the Institution of Mechanical Engineers, March 20.

Manby. She had feathering-float paddle-wheels, designed by Mr. John Oldham. She was followed by several sister iron steamers, constructed by Mr. Aaron Manby at the Horseley Works, and at his works at Charenton, near Paris. In 1845 the *Aaron Manby* was still running on the Seine.

In 1837, was built, at Birkenhead, by Mr. John Laird, an iron steamer, 198 ft. long, 26 ft. broad, 12⅔ ft. deep, 5½ ft. draught of water, 582 tons, 180 N.H.P., called the *Rainbow*. She served the General Steam Navigation Co. between London and Antwerp or Rotterdam for many years, and was remarkable for being driven by a pair of upright or "steeple" engines, by Messrs. G. Forrester & Co., Liverpool, which towered above her deck. Diameter of cylinders 50 inches, stroke 4½ ft.; diameter of paddle-wheels 21½ ft.; float-boards 10 ft. long.

PROGRESS ON THE THAMES.—On the Thames much activity in steamers is recorded between 1830 and 1840. The *Sophia Jane* steamer of 50 N.H.P., built in 1828 by Barnes & Miller, of Ratcliffe, was placed by them for service on the river. She was followed in 1829 by the *Kent*, *Pearl*, and *Essex*, owned by the Milton and Gravesend Steam Packet Co., which had been founded in 1827. The General Steam Navigation Co., founded in 1825, possessed in 1860 a fleet of 44 paddle steamers, registering 21,500 tons, and 7,000 N.H.P., built of wood and of iron, and trading from London to Holland, Belgium, France, and along the east coast of England and Scotland. The *Trident*, wood-built in 1841, by Wigram & Green, with lever engines of 260 N.H.P., 197½ ft. by 31 ft., 971 tons gross, served Her Majesty and the Prince Consort in 1842 as their yacht during a visit to Scotland. The *Waterwitch*, *Vivid*, *John Bull*, *Clarence*, *Soho*, and *Sir William Jolliffe* were wooden vessels, built 1824-40. The *Albion*, *Seine*, *Rhine*, *Moselle*, were iron vessels, built 1843-1852. Their passages were from London to Hamburg, Antwerp, Rotterdam, Ostend, Edinburgh, Hull, Yarmouth, and other ports.

The following particulars relate to the state of steam-vessel propulsion on the Thames.

1830.—St. Katherine's Dock Wharf was opened. The *Harlequin* steamer started on the first recorded excursion trip, to the Nore and back to London, on 9th April 1830. She carried 400 passengers.

1834.—The Town Pier at Gravesend was formally opened. The *Star* steamer landed there 500 passengers from London. The *Comet* steamer also worked on this station at same date. The success of these two vessels secured the stability of the Star Steam Packet Co., which was founded in 1833, and by the end of 1834 had five steamers running up and down the Thames between London and Gravesend: *Star*, *Comet*, *Vesper*, *Satellite*, and *Planet*. The *Vesper*, wood built 1836 by Fletcher; engines of 90 N.H.P. by Miller. The *Meteor*, iron built 1844 by Miller, 170 ft. by 18 ft. by 9 ft., mean draught 4 ft., 274 tons burden, speed 12·68 knots per hour, 80 N.H.P., cylinders 37 in. diameter, stroke 3 ft., paddle-wheels 15⅔ ft. diameter. These early vessels were replaced by the *New Star*, built and engined in 1847 by Miller & Ravenhill, 180 ft. by 17 ft. by 9 ft., 271 tons burden, oscillating engines of 70 N.H.P., feathering wheels; the *Jupiter*, built and engined in 1849 by Miller & Ravenhill, 165 ft. by 18 ft. by 9 ft., 265 tons burden, oscillating engines of 80 N.H.P., feathering wheels; the *Mars*, built in 1852 by Wigram, 180 ft. by 18 ft. by 10 ft., 291 tons burden, oscillating engines of 90 N.H.P., by Miller & Ravenhill, feathering wheels; the *Venus*, built in 1854 by Mare and Co., 180 ft. by 18 ft. by 9½ ft., 291 tons burden, oscillating engines of 90 N.H.P., by Miller & Ravenhill, feathering wheels.

1835.—The Terrace pier at Gravesend was built and opened, Mr. J. B. Redman being the engineer. This was the first work having hollow iron cylinders for the piers themselves, which when sunk into the river bed and secured were filled in with brick-work or concrete. The Star Company ran their steamers to this pier.

1835-7.—Woolwich Packet Co.'s vessels:—*Naiad*, *Fairy*, *Nymph*, *Ariel*, and *Sylph*. The last-named was built in 1838 by Maudslay and Field, and engined by them, 30 N.H.P. Later came the *Witch*, a very swift wooden boat, built about 1844, with oscillating engines by J. Penn & Sons; the *Dryad*, engined by J. Penn & Sons, speed 12·6 knots per hour, dimensions 123 ft. by 14 ft. by 6½ ft., gross tons 88, N.H.P. 40; the *Metis*, *Doris*, *Elfin*, and others. Mr. Thompson, of Rotherhithe, was the principal constructor of these Woolwich packets.

1838.—The Diamond Steam Packet Co. started five vessels on the Long Ferry from London to Gravesend. Their names were: *Diamond*, *Gem*, *Pearl*, *Topaz*, and *Ruby*, later appeared the *Sapphire*, and the *Emerald*, originally the *Prince Albert*. The *Ruby* was built by Wallis, and engined by Seaward in 1836; 155 ft. by 19 ft. by 10 ft., 272 tons burden, 100 N.H.P., cylinders 40 in. diameter, stroke 3½ ft., paddle-wheels 17½ ft. diameter, speed 13·17 knots per hour. In 1856 the fleet of the Star and Diamond Companies was entirely superseded by the railways on the north and south side of the river reaching to Tilbury and Gravesend respectively.

1840.—The London and Blackwall rope-railway was completed, Stephenson and Bidder being the engineers. The line was a double one, 3½ miles long, running on a viaduct of brick arches all the way, and with a falling gradient towards Blackwall. The haulage, at the rate of 25 miles per hour, was effected by powerful stationary engines at each end driving huge drum-wheels. The engines at the London terminus in Fenchurch Street were about 400 N.H.P. by Maudslay & Field; those at the Blackwall terminus were about 280 N.A.P. by Barnes. In 1842 the railway company ran three steamers of their own from Blackwall to Gravesend in connection with their trains. These steamers were the *Railway*, *Brunswick*, and *Blackwall*. The *Railway*, built by Ditchburn & Mare in 1842, was 145 ft. by 19 ft. by 10 ft., 258 tons burden, with oscillating engines by Penn of 90 N.H.P. giving a speed of 12·02 knots per hour. The *Brunswick*, also built by Ditchman & Mare in 1842, had direct-acting engines by Seward of 90 N.H.P., with 39½ in. cylinders and 3 ft. stroke; the paddle-wheels were 15½ ft. diameter. The *Blackwall* had a steeple engine of 90 H.P. by Miller & Ravenhill. The *Queen* by J. & G. Rennie, 160 ft. long, with 9 ft. depth of hold, speed 17 to 18 knots per hour, was also running at the same time on this station.

1841.—Waterman's Steam Packet Co. Iron-built vessels, chiefly by Ditchburn, plying against the Woolwich Steam Packet Co. and named *Waterman* Nos. 1 to 10. No. 10 was a swift boat. She had feathering float paddle-wheels, the float-boards being narrow and deep, instead of being wide and shallow.

(*To be continued*)

Miscellaneous.

THE Italian Ministry of the Navy has commissioned Messrs. Yarrow & Co. to build two boats of a larger and more powerful type than any before constructed. They are to measure 135 ft. in length, and are to be propelled by twin screws, worked by 1,200 H.P., calculated to give them a speed of 24 knots.

IN connection with the Special Service Evolutions the *Ajax* has been tested as to steering qualities. After an hour's trial the verdict was that she was "not as she ought to be, and not so bad as she might have been."

THE steamship *Carrier* has made her first trip from Langston to Brading—eleven miles. Her cargo consisted of twelve railway wagons of an aggregate weight (load and vehicle) of about 160 tons.

FOUR more gas-lighted buoys upon Pintsch's principle are just being sent off to the Suez Canal to join the eight already doing satisfactory duty there.

THE new steel corvette *Calypso*, 14, is ready for service. The *Calypso* is one of the largest and most powerful unarmoured corvettes in the British Navy, and is equipped with 14 steel breechloading guns, mounted on the Vavasseur system, together with torpedoes and Gardner and Nordenfelt machine guns. She is fitted with machinery of 3,000 H.P., supplied by Messrs. J. & G. Rennie, at a cost of £37,000. The total cost of the *Calypso*, including masts and rigging, is said to be about £130,000.

MR. GREENFELL, in the Thornycroft guide-blade propeller steamer *Peace*, has, according to recent despatches, made important explorations on the Mobangi, which turns out to be the greatest tributary to the Congo. It is navigable for a distance of 400 or 450 miles.

THE christening of the three ironclads which have been built at Kiel for the Chinese Government, took place on July 3rd in presence of the Chinese Ambassador, the ceremony being of a religious character. The vessels sailed in the afternoon for China, *viâ* Plymouth.

MR. ROBERT HARROWING, one of the largest steamship managers and owners in the North of England, has announced that, owing to the continued depressed state of the freight market, he has determined to lay up the whole of the vessels of his fleet as they arrive in England. About a quarter of a million of capital will thus be laid idle.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—ED. M. E.]

LAUNCHES—ENGLISH.

Emilie.—On June 26th Messrs. Edward Withy & Co., West Hartlepool, launched an iron screw steamer, named *Emilie*, from their yard. The vessel has been built to the order of Messrs. Burdick & Cook, London, and will carry about 2,100 tons. She has a long raised quarter-deck, with a short raised poop, long bridge, house, and topgallant forecastle, and is fitted with double bottom on the McIntyre principle, and coated with Day's patent cement. The vessel has four iron watertight bulkheads, and the main, quarter, bridge and topgallant forecastle decks, bulwarks, rails, skylights, &c., are of iron. She is fitted with Cochrane's multitubular donkey boiler, four steam winches by Messrs. Clarke, Chapman & Co., patent windlass by Messrs. Emerson, Walker, & Thompson Bros., patent hand and steam steering gear amidships by Messrs. Davis & Co., Hastie's right and left steering gear aft, three of Wasteney's Smith's patent stockless anchors, and Withy's improved screw frame and rudder, which adds considerably to the strength of the vessel at the stern, and improves the steering power, as demonstrated in the vessels lately built by the firm. The saloon for the use of passengers, captain, and officers is lofty and light, and finished in polished hardwood. Elegantly painted panels, executed in oils in the most pleasing and effective style, are ranged along each side of the saloon, the design and execution being by the decorative staff employed by the builders. The vessel is rigged as a two-masted topsail schooner, and built under Lloyd's special survey for the 100 A1 class, and under the personal superintendence of Mr. Cook. She will be fitted with triple expansion engines of 150 N.H.P. by Messrs. Blair & Co., Stockton-on-Tees. A party of ladies and gentlemen came down to the launch, including M. and Madame Cocquerel, Mdlle. Cocquerel, Mr. and Mrs. Burdick, Mr. and Mrs. Cook, Mr. and Mrs. Cole, of London, M. A. Letellier, of Paris, and others. They were entertained to dinner by the builders at the Royal Hotel, and after the launch drove to Stockton-on-Tees.

Bagdhadi.—On June 27th the new steamer *Bagdhadi*, built to the order of the Persian Gulf Steamship Company, was launched from the Neptune Yard, Newcastle. She is 255 ft. long by 34 ft. 9 in. beam by 25 ft. 6 in. deep, and will be fitted with engines of 800 H.P. of the new triplex style, having cylinders of 21½ in. and 33 in. and 55 in. diameter by 39 in. stroke, with a boiler pressure of 150 lbs. She has been superintended during construction by Messrs. Flannery & Baggallay, of London, consulting engineers to the company, and it is expected that she will exceed in speed the fine vessels of this company already running up the Gulf. She has Christie's patent arrangement of tanks, and also his patent frame, which would appear to be a great improvement; and also Tweedie's arrangement of condenser to the winches, by which a considerable saving of fuel is expected, besides convenience to passengers from the absence of steam and noise. She will be fitted with first-class passenger accommodation, and arranged with light and ventilation, that a large number of troops or pilgrims may be carried if at any time found requisite.

Raphael.—On June 30th there was launched from Messrs. Joseph L. Thompson and Sons' North Sands ship-building yard. Sunderland, an iron screw steamer, to the order of Mr. Frederick Bolton, of London, built under special survey to class 100 A 1 at Lloyd's and designed for a deadweight capacity of about 2,500 tons. She is fitted up on the forecastle with Napier's patent steam windlass, with an outfit of Wasteneys Smith's patent stockless anchors arranged to draw into the hawse pipe direct from the windlass, dispensing with the usual anchor davits, or crane and fish tackles, &c.; Halliday's steam steering gear amidships, "Cestus" donkey boiler, and winches by Messrs. Clarke, Chapman, and Co., Gateshead. The vessel will be fitted with engines by Messrs. Thomas Richardson and Sons, of 160 N.H.P., working at a pressure of 90 lbs. During her construction, the vessel has been under the supervision of Mr. Terrot Glover, of Sunderland. As the vessel left the ways she was named the *Raphael* by Mrs. William Thackwray, jun., of Sunderland.

Queen of the Usk.—On July 1st there was launched at Newport (Mon.), from the yard of Messrs. Mordey, Carney & Co. (Limited), a steamtug-boat, which was named the *Queen of the Usk* by Mrs. Kendrick. The boat was afterwards taken into the firm's dry dock, where she will be fitted out with all modern appliances. Her dimensions are:—length, 84 ft.; breadth, 16 ft.; depth, 10 ft. 6 in. She will be fitted with a pair of compound surface-condensing marine engines, 18 and 33. The boiler is 9 ft. 6 in. long, and 10 ft. 9 in. in diameter. The whole of the machinery was constructed by the firm. The steamer has been built for the firm's own use for towing ships in the Bristol Channel, and to and fro from the dry dock to the Alexandra and Old Docks.

Condor.—On July 2nd there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt and Co., at Southampton, an iron barque of 1,300 tons nett register, of the following dimensions:—Length, 229 ft. 7 in.; breadth, 37 ft. 3 in.; depth of hold, 21 ft. 6 in. The vessel has been built to the order of G. Petrie, Esq., of London. Accommodation is provided for captain and officers in full poop, and for petty officers and crew in large iron deckhouse amidships. She is fitted with Harfield's windlass and capstan combined, for working anchors and chains. Lighthouses on forecastle. During construction the vessel has been under the supervision of Mr. James Wilkinson, marine surveyor, Liverpool. As the vessel left the ways she was christened the *Condor*, by Miss Nora Petrie.

Gian Paolo.—On July 10th there was launched from the yard of the Sunderland Shipbuilding Company, Limited, a finely modelled iron screw steamer, built to the order of Messrs. Gracopini Bros., of Spezia, Italy. Her leading particulars are—length, 152 ft. 6 in., B.P., by 23 ft. 6 in. breadth, by 12 ft. 3 in. depth of hold, classed 100 A1 Lloyd's, under special survey, having raised quarter-deck, bridge, and topgallant forecastle. The machinery is by the North-Eastern Marine Engineering Co., Limited, having cylinders 20 in. and 38 in. by 27 in., stroke, large boilers and all the latest improvements. The vessel is intended for the wine trade, and is fitted up in a suitable way. When completed she will be commanded by Captain Reboa. On leaving the ways she was gracefully named the *Gian Paolo* by Miss Wilson, daughter of Captain Wilson, of Sunderland.

Newcastle.—On July 11th there was launched from the shipbuilding-yard of Messrs. C. S. Swan & Hunter, Wallsend, a steel screw steamer, built to the order of Messrs. J. J. & C. M. Forster, Newcastle, of the following dimensions, viz.:—Length over all, 253 ft.; breadth, 34 ft.; depth moulded, 18 ft. 6 in. The vessel has a long raised quarter-deck, long bridge house amidships, and topgallant forecastle, ample water ballast in double bottom, and peaks is divided by five watertight bulkheads, will carry about 2,000 tons dead weight, and is fitted with steam steering gear, four steam winches, and every modern appliance. The engines are by the North Eastern Marine Engineering Company (Limited), Wallsend, on the triple expansion surface condensing principle, to work at 160 lbs. pressure, and are capable of indicating about 800 H.P. On leaving the ways the steamer was named the *Newcastle*, by Mrs. C. M. Forster.

Ocean Prince.—On July 11th Messrs. Short Brothers launched from their yard at Pallion, Sunderland, a screw steamer, built to the order of the Prince Steam Shipping Company, Newcastle-on-Tyne, of the following dimensions: Length, per register, 262 ft.; breadth, 37 ft., and 21 ft. depth of hold to ordinary floors. The vessel has been constructed under special survey to the highest class in Lloyd's Register for iron vessels. She is fitted with cellular double bottom all fore and aft, and has a short raised quarter-deck, long bridge amidships over engine and boilers, and topgallant forecastle. On leaving the ways the vessel was named the *Ocean Prince* by Miss Nicholson, of Birtley. After the launch the vessel was towed to the works of Mr. John Dickinson, by whom will she will be fitted with triple expansion engines of 160 N.H.P., the boilers being of steel, with a pressure of 150 lbs. The vessel during construction has been superintended on behalf of the owners by Mr. M'Coy, and will be commanded by Captain Milburn.

Wells City.—On July 11th there was launched from the establishment of the North of England Shipbuilding Company

Limited, a screw steamer of the following dimensions:—280 ft. long by 36 ft. beam by 23½ ft. depth of hold. The vessel has been built to the order of Messrs. Charles Hill & Sons, of Bristol, for the highest class at Lloyd's. The steamer is built of steel on the Siemens-Martin principle, and, being intended for the Atlantic trade, has been strengthened even beyond the requirements of Lloyd's Registry. The vessel will be rigged as a two-masted schooner, and is provided with five steam winches and two large donkey boilers by Messrs. Clarke, Chapman, & Co., Gateshead; steam steering gear by Bow, M'Laughlin, & Co., Paisley; Hastie's (Greenock) after steering gear, fitted with Hastie's patent guides; and steam windlass by Emerson, Walker & Co., of London. After the launch, the vessel proceeded to Hartlepool, where Messrs. T. Richardson & Son will place on board engines of 220 H.P., on the triple-expansion principle, embracing all the latest improvements for economic working. The christening ceremony was performed by Miss Hill, daughter of the senior owner, the name given to the vessel being *Wells City*. The vessel during construction has been under the inspection of Mr. Bailey, Messrs. Hill & Sons' shipyard foreman, and Captain Weiss, who will take command on her completion.

Va y Ven and Ven y Va.—On July 13th, Messrs. Cochrane, Hamilton, & Co. launched from their shipbuilding yard at Beverley, two iron twin screw steamers of about 200 tons burthen, built to the order of Senor Juan de Longa, of Bilbao, intended to carry on the local coasting trade round the coast. The engines are twin screw, of 36 N.H.P., with one of Cochrane's patent tubular boilers of their latest type, having two horizontal furnaces. Both engines and boilers are supplied by Messrs. Cochrane & Co., of Birkenhead. The vessels were named the *Va y Ven and Ven y Va*. Both vessels and machinery have been designed and built under the superintendence of Mr. James Rode, consulting engineer, of Liverpool.

Carl Rahtkens.—On July 14th there was launched from the shipbuilding yard of Messrs. John Readhead & Co., West Docks, South Shields, an iron-screw steamer of the following dimensions, viz., 259 ft. by 37 ft. by 17 ft. 9 in., and having a carrying capacity of 2,300 tons dead weight. The vessel is classed 100 A1 Lloyd's, and will be fitted with compound surface condensing engines of 150 H.P. The engines and boilers are also built by Messrs. Readhead. The steamer has been built to the order of Messrs. Franz Rahtkens & Co., of Middlesborough, and was named the *Carl Rahtkens* by Senora Cano, of Valencia.

Editor.—On July 14th Messrs. M. Pearse & Co. launched from their shipbuilding yard at Stockton-on-Tees, a steel screw steamer of the following dimensions, viz.:—Length, 250 ft.; extreme breadth, 33 ft. 11 in.; depth of hold, 23 ft. The gross register tonnage is about 1,600 tons. This vessel has been built to the highest class at Lloyd's, has spar deck, bridge house amidships, cabin in house aft; has four steam winches, Emerson & Walker's patent windlass, and the appliances for loading and discharging cargoes are very complete. Her engines are by Messrs. Blair and Co., of Stockton, and are on the triple expansion principle. She is rigged as a two-masted schooner, and is built so as to obtain a passenger certificate. The christening ceremony was performed by Miss Fanny Hopper, who gave the vessel the name of *Editor*.

Hecate.—Alarm.—On July 15th Messrs. W. H. Potter and Sons launched from their shipbuilding and engineering works, Queen's Dock, Liverpool, two iron vessels, namely:—An iron screw steamer of the following dimensions:—Length, 240 ft.; beam, 34 ft.; depth in hold, 16 ft.; tonnage, B.M., 1,350 tons. As the vessel left the ways she was named the *Hecate* by Miss M. Crompton. The *Hecate* is the first of two vessels that Messrs. Potter & Sons have in hand for Mr. Alfred Holt of Liverpool. She will be fitted with compound service condensing engines of the most approved type, also with three steam winches, steam pumps, and steam windlass, and fittings for carrying cattle on main deck. The second vessel was an iron twin screw steamer, which has been built to the order of the Mersey Docks and Harbour Board. She is to be fitted out as a steam watch vessel, for which purpose she has been specially designed and built, and is of the following dimensions:—Length, 120 ft.; beam, 21 ft.; depth, 13 ft.; tonnage, B.M., 252 tons. The vessel was named the *Alarm* by Miss Sweeney. The *Alarm* will be fitted with a pair of direct acting compound surface condensing engines.

Quinta Hermosa.—On July 17th, Messrs. Fullarton & Co., Paisley launched an iron screw steamer, named the *Quinta Hermosa*, built to the order of Marquis de Monroy, of Seville, Spain. The vessel, which is about 140 tons register, is partly intended for Spanish coasting trade, and partly for pleasure excursions for the Marquis and his friends. Besides the ordinary cabin for captain and officers, which is aft under a quarterdeck, there is a large bridge house amidships, with a saloon and state rooms, exclusively for the use of the Marquis and his friends, fitted up internally as in a first class yacht. The engines are compound surface condensing, of 30 N.H.P., with a horizontal tubular steel boiler, Duncan's patent propeller, &c., and will be supplied by Messrs. Ross & Duncan, of Glasgow. The vessel and machinery have been built under the superintendence of Mr. James Rode, consulting engineer, of Liverpool.

Ariel.—On July 18th Messrs. Earles Shipbuilding and Engineering Co., Limited, launched from their yard a large steel screw steamer, built to the order of Edward Leetham, Esq., of Hull. The dimensions of the vessel are as follows:—Length, 300 ft., breadth, 42 ft., depth to floors, 20 ft. She is built to Lloyd's 100 A1 class for steel steamships, has a raised quarter-deck aft, long bridge amidships over engines and boilers, and topgallant forecastle forward, with turtle back sides, and will be rigged as a barquentine. It will be seen that she is adapted for carrying a large cargo on a moderate draft of water. Water ballast is provided under engines and boilers, and there is also a deep tank in the main hold, which can be used either as a ballast tank or for cargo. The saloon and state-rooms are fitted in a large iron house on the bridge. The officers are berthed in houses on the bridge at sides of the engine casing. The four steam winches are made by Earles Company, three of them being of their special long-stroke compound type. These winches will be supplied with steam from a large donkey boiler, as well as from each of the main boilers. The vessel will be fitted with steam steering gear by Messrs. Amos & Smith, and with a steam windlass by Messrs. Harfield & Co. The engines are on the three-crank triple compound system of 250 N.H.P., and with two large steel double-ended boilers to work at 150 lb. pressure. The machinery, which has also been made by the builders, is the fifteenth set on this system turned out by them.

Semiramis.—On July 18th there was launched from the yard of the Sunderland Shipbuilding Company, Limited, a finely modelled screw steamer, built to the order of Wm. Watt, Esq., of Helensburgh. The leading particulars of the vessel are—length, B.P., 152 ft. 6 in. by 23 ft. 6 in. by 12 ft. 3 in., classed 100 A1 Lloyd's, having raised quarter-deck, bridge and topgallant forecastle, with first-class accommodation for passengers amidships. The engines are by the North-Eastern Marine Engineering Company, Limited, having cylinders 20 in. and 38 in. by 27 in. stroke. The vessel is built upon very fine lines, and is expected to attain a speed of about 12 knots per hour. On leaving the ways the steamer was named *Semiramis* (*pro. tem.*) by Mrs. Watt, wife of the owner.

Steam Launch.—On July 25th, Messrs. Edwards & Symes successfully launched from their shipbuilding yard at Cubitt Town, a sea-going steam launch for the Corporation of the City of London Port Sanitary Committee, for the use of Dr. Collingridge, between Teddington and the Nore. As soon as the launch was afloat, it was taken alongside the wharf, and the boiler and machinery put on board. Its dimensions are:—55 ft. long, between perpendiculars, 11 ft. beam, and 6 ft. deep. The machinery is of the compound surface condensing type, with extra large boiler. The expected speed is from 10 to 11 miles an hour.

LAUNCHES.—Scotch.

Sternwheel Gunboat.—On June 9th Messrs. John Elder and Co., Fairfield, Govan, launched one of the two sternwheel gunboats built by them for the War Office for service on the Nile. She is constructed wholly of steel, and has a spoon-shaped bow and a square stern; she measures 100 ft. by 18 ft. by 4 ft. 6 in., and her draught is 2 ft. 6 in. There is a large house on the main deck, with rooms for captain, surgeon, and officers. Her forward bulwark is bullet-proof, with the necessary loopholes for firing. She is fitted with compound surface-condensing engines, capable of developing a speed of 12 miles an hour while on service. The boiler is of the locomotive type, and is adapted for burning either wood or coal.

White Rose.—On June 13th Messrs. E. Finch & Co., Limited, launched from their shipbuilding yard, Chepstow, a screw tug, built to the order of Messrs. D. B. M'Cullom & Sons, of Cardiff. Her principal dimensions are:—Length, between perpendiculars, 95 ft.; beam, extreme, 19 ft. 6 in.; and depth of hold, 11 ft. 8in.

She is intended for long sea towing, and will be fitted by the builders with compound surface-condensing engines, having cylinders 20 in. and 34 in. by 24 in. stroke, and a boiler 12 ft. 6 in. by 10 ft., designed for a working pressure of 80 lb. As she left the ways she was christened the *White Rose*.

Alert.—On June 20th Messrs. John Fullerton & Co. launched, from Merksworth Building Yard, Paisley, an iron screw steamer of 125 tons b.m., built to the order of Mr. John T. Lainé, of Guernsey. She is is intended for the passenger traffic during the summer months between the Channel Islands, and for towing purposes in winter. The engines, of the compound type, of 65 N.H.P., will be supplied by Mr. William Kemp, of Helen-street, Govan.

Leven.—On June 26th, the twin-screw patent hopper dredger *Leven*, of 800 tons capacity and 600 H.P., was successfully launched by Messrs. Wm. Simmons & Co., Renfrew. It is fitted with the builders' patent traversing bucket ladder, to project in front, and cut its own way in shoals and banks to 35 ft. depth of water as may be required, and dredge 400 to 500 tons of spoil per hour. It has two pairs of compound surface-condensing engines, fitted with Murdoch's patent governors, and two mild-steel boilers, constructed to the Board of Trade and Lloyd's rules for a working pressure of 90 lb. per square inch. Each pair of engines drives its own propeller, and either pair is available for dredging. Steam-steering gear is also fitted, and three powerful mooring windlasses combined in one machine are placed at the bow and stern for bringing the vessel to work. The bucket ladder is controlled by an auxiliary engine placed forward, and the upper tumbler is driven by a large wheel which is fitted with a friction centre to avoid accidents to the machinery. The hull, gearing, and buckets are made chiefly of steel, and altogether when completed the *Leven* will be one of the finest of her class afloat. This vessel is the property of the Dumbarton Harbour Board, and has been constructed under the supervision of their sub-committee —Messrs. Wm. Denny, Walter Brock, and R. M'Millan, and the Board may be congratulated upon the enterprise they have shown in acquiring such a powerful and improved type of vessel to dredge the river Leven, where, we are sure, she will give a good account of herself. We may mention that the *Leven* is the twenty-first hopper dredger that the builders have constructed.

Vaitarna.—On June 27th the Grangemouth Dockyard Company launched a steel screw steamer named the *Vaitarna*, a vessel measuring 177 ft. over all, by 26 ft. 6 in. by 10 ft. 5 in., or 17 ft. to the awning deck. She had been built to the order of Mr. J. A. Shepherd, for the Bombay Steam Navigation Company, and has been specially designed for passenger service, for which her accommodation will be very extensive. Her fittings will include all the latest improvements, and she will be fitted throughout with electric lighting arrangements, the contract for which has been placed with Messrs. King, Brown, & Co., Edinburgh. Messrs. Dunsmuir and Jackson, Glasgow, who are the contractors for the vessel, are supplying her with compound engines, which are expected to indicate 500 H.P., and to develop a speed of 13 knots per hour. Steam will be supplied from a double-ended steel boiler, carrying a pressure of 115 lb. per square inch. The vessel is provided with seven water-tight bulkheads, and is placed on the Admiraly list.

Mararoa.—On June 29th, Messrs. William Denny & Brothers, Leven Shipyard, Dumbarton, launched a steel screw steamer, of about 2,500 tons gross register, for the Union Steamship Company of New Zealand. The steamer, which on leaving the ways was named the *Mararoa* by Mrs. John Darling, is 320 ft. in length between perpendiculars, 42 ft. breadth moulded, and 26 ft. moulded depth. She has been constructed of Siemens-Martin steel, under special survey of Lloyd's, and is classed in their registry 100 A 1 three decked. She is built with a continuous cellular bottom for water ballast, and has complete upper and main decks, a lower deck forward and aft of machinery space, also a promenade deck over the greater portion of the vessel, surmounted by a roof or shade deck. Saloon and state-room accommodation will be provided on the main and upper decks for 144 first-class and 109 second-class passengers. The *Mararoa* will be fitted by Messrs. Denny & Co. with direct-acting surface-condensing engines on the triple expansion principle, of about 2,600 H.P., with steam at 160 lbs. pressure, and hydraulic gear will be fitted throughout the vessel for working cargo, raising the anchors and boats, and for steering. While under construction the *Mararoa* has been under the inspection of Mr. John Darling, marine superintendent for the Union Steamship Company of New Zealand.

Inishtrahull.—On June 29, Messrs. David & William Henderson & Co., launched from their Meadowside Works, Partick, a steel screw steamer of the following dimensions:—231 ft. by 33 ft. by 17 ft. 9 in. moulded; gross tonnage 970 tons. The vessel, which is built to the order of the Clyde Shipping Company, 21, Carlton-place, is fitted with all modern appliances, has accommodation for 40 first-class passengers in the poop, and is adapted for carrying cattle on the main deck, lower decks, and hold. She will be fitted by her builders with triple-expansion engines of the most approved designs, cylinders being 25 in., 37 in., and 58 in. by 4 ft. length of stroke, indicating 1,200 H.P., and with a working pressure on boilers of 130 lbs. per square inch. A ballast tank has been fitted fore and aft, with the most recent improvements for filling and discharging same. On leaving the ways the vessel was named *Inishtrahull* by Mrs. James Cuthburt, of Bothwell.

Crown of India.—On June 30th, Messrs. Ramage & Ferguson, Leith, launched from their yard an iron sailing ship of 1,970 tons nett, named the *Crown of India*, built to the order of Messrs. Robertson, Cruickshank & Co., Liverpool, and intended for the Australian trade. The dimensions are:—Length 265 ft. (between perpendiculars); breadth, 41 ft.; depth 25 ft. 7 in. (moulded). The vessel, which will have a carrying capacity of 3,200 tons dead weight, has been built to the highest class at Lloyd's, and is considerably above their requirements in some respects. She will be barque-rigged, and will have four masts and double topsail yards. The vessel has a full poop and forecastle, with deckhouse amidships. Miss Roberts, Liverpool, performed the naming ceremony.

County of Edinburgh.—On June 30th Messrs. Barclay, Curle & Co. launched from their shipbuilding yard, Whiteinch, this four-masted iron sailing ship of about 2,130 tons gross register, for the County Line of Messrs. R. & J. Craig, Glasgow. The vessel's dimensions are:—275 ft. by 42¼ ft. by 24 ft.

Frances Fisher.—On July 2nd, Messrs. A. M'Millan & Son launched from their dockyard, at Dumbarton, a steel barque of 1,470 tons register, named the *Frances Fisher*. The new vessel is to be furnished and outfitted in the most approved style, and on completion will be placed on the berth to be loaded by Messrs. Aitken, Lilburn & Co., for Sydney. The christening ceremony was performed by Miss Frances Fisher, daughter of F. R. Fisher, Esq., of London, the owner of the vessel.

Phœnix.—On July 6th Messrs. Fleming & Ferguson launched from their shipyard at Paisley this steam yacht. She is particularly noticeable in respect of being fitted by her builders with quadruple compound engines for working at a pressure of 200 lb. per square inch. It is anticipated that this further extension of the system of compound engine will, with the attendant economy in fuel, enable steamers to be run even in these bad times. It is intended to make a series of experimental trials of the *Phœnix* on the Clyde, and the result will be watched with some interest.

Argo.—On July 13th, Messrs. Scott & Co., ship builders, Cartsdyke, launched from their yard a pleasure steamer of 300 tons gross, and of the following dimensions:—Length, 140 ft; breadth, 23 ft. 4 in.; and depth, 14 ft. 2 in. The steamer, which has been built to the order of Mr. Alfred Holt, shipowner, Liverpool, was, on leaving the ways, named the *Argo*. She will be engined by the Greenock Foundry Company.

Gladstone.—On July 13, Messrs. Fleming and Ferguson launched from their shipyard, near Paisley, a dredger named the *Gladstone*. She has been built for the Wick and Pulteney Harbour Trustees, and will be employed by them in carrying out the improvements that are about to be made on Wick Harbour. Her dimensions are 100 ft. by 22 ft. by 7 ft. 6 in., and she is so designed that she can cut in advance of her hull, and so clear a channel for herself. Her dredging capacity is about 1,300 tons per day, and she is fitted with self-propelling gear to control her own movements. During construction she has been under the supervision of Mr. J. W. Baron, C.E., engineer for Wick harbour, and Mr. James Donaldson, consulting engineer, Glasgow.

Ochtertipe.—On July 14th there was launched from the yard of Messrs. R. Duncan & Co., Port Glasgow, an iron sailing barque of 1,300 tons nett register. On entering the water she was named *Ochtertipe*; and is built to the order of Mr. Hugh Hogarth, Ardrossan, for the East India trade. Her dimensions are:—Length, 225 ft.; breadth, 37 ft.; depth. 21 ft. 6 in.

Arctic Stream.—On July 15, Messrs. Russell & Co., launched from their East End yard at Port Glasgow, an iron sailing ship, named the *Arctic Stream*, of the following dimensions:—Length, 250 ft.; breadth, 38 ft. 3 in.; depth, 22 ft. 9 in.; and of 1,300 tons. This vessel, which is sister ship to the *Gulf Stream*, launched a few months ago by the same firm, was built under the personal superintendence of Captain L. Polson, Glasgow, by whom she is owned. She has been constructed to the highest class at Lloyd's, and has been fitted with all the latest and improved appliances, including Messrs. Emerson, Walker, & Thompson Bros'., limited, patent capstain windlass, being specially designed for the East Indian climate, for which trade she is intended to be employed.

Screw Steamer.—On July 15th there was launched from the ship-building yard of Mr. W. S. Cumming, Blackhill Dock, Monkland Canal, a screw steamer 45 ft. by 10 ft. by 5 ft. 8 in. modelled. This vessel is intended for towing purposes, and is suitably fitted up for same. The whole of the hull, including the deck, is of steel, all deck fittings are of teak, and otherwise the vessel is fitted up complete ready for service. The engines, which are compound surface-condensing, having cylinders 7 in. and 13 in. diameter, and indicating about 55 H.P., are being constructed by Mr. William Kemp, Govan. This vessel is the first of two at present being constructed by the same builder.

Hopper Dredger.—On July 15th there was launched at Renfrew the first of two hopper dredgers which are being constructed by Messrs. Wm. Simons & Co., for the Belfast Harbour Commissioners. It is intended that both vessels shall work night and day, and they will be chiefly engaged in cutting a deep sea channel of considerable length on the Belfast Lough. This work will be greatly facilitated by means of the builders' patent traversing gear, which will enable them to cut the bank away in front to a depth of 35 feet if required. Independent, however of the part they will perform in the making of the channel, they will be found more suitable for harbour and dock work, as the traversing arrangements will enable them to dredge into corners or alongside harbour walls. Independent steam action is used for elevating, lowering, and traversing the bucket ladder, while the main engines are left free for the propulsion of the vessel and of dredging proper, and are so arranged that either can be done instantaneously when required. The hopper has a capacity for 800 tons of its own dredgings, which can be filled at the rate of 400 tons per hour. When loaded, the vessel will steam and deposit the cargo at a speed of nine miles an hour, the one crew being available for dredging and sailing the vessel as required. Steel has been extensively used in the construction of the buckets, tumblers, and wheel gearing, which will in a very great degree minimise the wear and tear. The engines consist of two pairs of compound surface-condensing engines of 600 I.H.P., fitted with all recent improvements, including Tangye's improved high-speed regulating governors, steam starting-valves, &c. The main boilers are of ample dimensions, and are constructed of steel for a working pressure of 90 lb. per square inch. An auxiliary boiler, also of steel, is placed in stokehold, and will be used for circulating water in boilers, or supplying steam to the winches.

Clan M'Pherson.—On July 16th Messrs. Russell & Co. launched from their yard, Kingston, Port Glasgow, an iron sailing ship of 1,600 tons register, her dimensions being 260 ft., 28 ft. 3 in. in breath by 28 ft. 3 in. deep. On leaving the ways she was named *Clan M'Pherson.* She is built to the order of Messrs. Thomas Dunlop & Sons, Glasgow, and is sister ship to the *Clan M'Farlane*, also belonging to Messrs. Dunlop.

Quinta Hermora.—On July 17th Messrs. Fullarton & Co., Paisley, launched an iron screw steamer, named the *Quinta Hermora*, built to the order of Marquis de Monroy, of Sevilla, Spain. The vessel, which is about 140 tons register, is partly intended for Spanish coasting trade and partly for pleasure excursions for the Marquis and his friends. Besides the ordinary cabin for captain and officers, which is aft under a quarterdeck, there is a large bridge-house amidships with a saloon and state-room, fitted up internally as in a first-class yacht. The engines are compound surface-condensing of 30 N.H.P., with a horizontal tubular steel boiler, Duncan's patent propeller, &c., and will be supplied by Messrs. Ross & Duncan, of Glasgow. The vessel and machinery have been built under the superintendence of Mr. James Rhode, consulting engineer, of Liverpool.

LAUNCHES—Irish.

Lady Arthur Hill.—On June 29th a handsome screw steamer was launched from the shipbuilding yard of Messrs. McIlwaine and Lewis, Belfast. She is for the East Downshire Steamship Company, Dundrum, for the purposes of the cattle trade. Her dimensions are:—Length, 150 ft.; breadth, 23 ft.; depth of hold, 12 ft., and will carry a cargo of 390 tons. Accommodation is also provided for passengers, and will be fitted out in a superior style. The *Lady Arthur Hill* will receive her engines and boiler at the hands of the builders, Messrs. McIlwaine & Lewis.

Fort James.—On July 1st a finely modelled iron sailing vesse was launched from the shipbuilding yard of Messrs. Workman, Clark & Co., Limited, Belfast, to the order of Messrs. Clark and Service, Glasgow. She has been built to class 100 A1 at Lloyd's. Her dimensions are:—Length, 261 ft. 4 in.; breadth, 40 ft.; depth of hold, 23 ft. 3 in. The net registered tonnage is 1,695 tons, and the deadweight carrying capacity 2,590 tons. The christening ceremony was very gracefully performed by Miss Edith Matier, who gave the vessel the name *Fort James*. After the launch the *Fort James* was towed to the Abercorn Basin where she will receive her masts at the large shear legs. Captain Houston—who has just arrived with the *Fort George*, a four-masted vessel, built for the same owners by Messrs. Workman, Clark & Co.—will take command of the *Fort James*. The *Fort James* is a three-masted vessel, and is fitted up in the most approved style. The saloon is fitted up with polished wood and upholstered in velvet; the ship will have a full East India outfit, and is expected to be ready for sea in about a month.

Venture.—On July 12th a steamer named the *Venture* was launched at Londonderry. The selection of the day was not in the choice of the owners, as the vessel had to be run across the Great Northern Railway track, and Sunday was the only day that afforded an uninterrupted opportunity, there being few trains running. Much local interest attached to the event, as a local artisan, Thomas Cooper, had invented a novel application of screw power, to test which the steamer was built. The invention is in having the propeller nearly amidships, slightly back towards the stern quarter. It is claimed for it that it will do away with the racing of engines, the screw being in all weathers under water. The new steamer has a length of 85 ft., and is built of steell throughout. The workmanship is entirely local.

LAUNCH—German.

Kilwa.—On June 23rd a new cargo steamer was launched from the Flensburg shipbuilding yard. She is 140 ft. by 22 ft. by 13 ft. The engines are of 200 I.H.P., and she is built for the Sultan of Zanzibar. Besides having all newest improvements for general cargo trade, she is fitted with a saloon and four berths aft under poop in Oriental style, intended for the private use of the Sultan. She was named the *Kilwa*.

TRIAL TRIPS.

Ormerod.—On May 18th the *Ormerod* (s), built to the order of Colonel Thursby and the Executors of Burnley Colliery, by Messrs. Oswald, Mordaunt & Co., of Southampton, ran a successful trial on the measured mile in Stokes Bay. On the measured mile the speed attained at 80 lbs. of steam and 70 revolutions was nine knots. After the trial the *Ormerod* left for Fleetwood. The ship's frames were started on April 16 last, and the ship was launched on the 27th of June. She is built on the cellular principle, and classed 100 A 1 at Lloyd's, but is very far in excess of their requirements for a vessel of her class, and is of great additional strength in her bottom to make her safe for grounding in tidal harbours. The steamer has been built under the supervision of Captain George Richards, who has taken command of her. The engines and boiler are built by the same firm; the engines are inverted surface-condensing compound, with cylinders 21 in. and 42in. diameter and 30 in. stroke. There is one large steel boiler of 100 lbs. pressure. She is fitted with Higginson's Steam Quarter-master steering-gear.

Ernst Gunther.—On June 1st the trial trip was held of the the new passenger steamer, *Ernst Gunther*, built by the Flensburgh Shipbuilding Company for the Steamship Company Flensburgh-Ekensund. She is of the following dimensions:—116 ft. by 21½ ft. by 9 ft. and her engines are of 260 I.H.P. She has on the afterdeck a large saloon, on top of which is a broad promenade deck. She is intended for pleasure trips and regular route on the Flensburg Bay, running a speed of 11-12 knots, and having seats for 500 to 600 passengers. She brings a good lot of the inhabitants of Flensburg out to the fine forest places which surround the bay in an extension of about twenty miles.

Melbourne.—On June 12th this, the largest barge-loading dredger in the world, was successfully tried on the bank off Greenock. The principal dimensions are:—Length, 207 ft.; breadth, 35 ft.; depth, 11 ft. 6 in. The bucket ladder works through a well in the centre of the vessel, and is fitted with one row of buckets, each containing about 22 cubic feet of dredgings. There are two pairs of compound surface-condensing engines of 670 I.H.P. collectively, and working independently—one pair available for each propeller, and either or both pairs will drive the buckets. The ladder works to a depth of 37 ft., and the dredgings are discharged over one or both sides at pleasure. The side shoots are worked by small independent engines, which are encased and conveniently situated on deck. There are triple-geared bow and stern winches, having each three separate chain barrels. The ladder, which weighs nearly 150 tons, is controlled by powerful hoisting and lowering appliances and disengaging gear. The vessel was built by Wm. Simons & Co., Renfrew, to the order of the Melbourne Harbour Commissioners, and is the fifth dredging vessel which the builders have constructed for Melbourne. After the moorings were all set, the machinery was put in motion, and the huge buckets came up at the rate of 16 per minute, equal to 800 tons an hour, completely filled with stiff clay. The gearing worked with the utmost smoothness. The vessel then ran the measured mile, which was accomplished at the rate of nearly eight knots per hour.

Rodney.—On June 18th the steel armour-plated barbette ship *Rodney*, ten guns, 9,600 tons, 7,000 H.P., returned to Chatham Dockyard, after a successful series of trials of her engines, as briefly mentioned in the July number of the MARINE ENGINEER. The official trial, which took place on the previous day, was of the most satisfactory character. With a natural draught the following results were obtained:—Mean I.H.P., starboard, 4,222; port, 4.040; collective, 8,262; steam in the boilers, 89 lb.; vacuum in condensers, starboard, 28·5 inches; port, 28 inches; revolutions per minute, starboard, 94; port, 93; mean pressure in cylinders, starboard, high, 45·61; low, 11·74; port, high, 43·44; low, 11·50. With forced draught and enclosed stoke-holes, the following results were obtained:—Mean I.H.P., starboard, 5,598·55; port, 5,558·21; collectively, 11,156·76; steam in the boilers, 90 lb.; vacuum in condensers, starboard, 27·5; port, 28; revolutions, starboard, 104; port, 103; mean pressure in cylinders, starboard, high, 59·75; low, 12·83; port, high, 60·10; low, 12·78. The rate of speed attained was beyond that anticipated, over 17 knots per hour being made, notwithstanding the fact that the vessel's bottom was foul through having been in the basin at Chatham so long. The machinery worked with smoothness and regularity throughout, the boilers generating an ample supply of steam, and no hitch of any sort occurred.

Corangamite.—On June 20th, the trial under steam of the screw steamer *Corangamite*, a sister vessel to the screw steamer *Burrumbeet*, took place, when the vessel steamed full speed for six hours without any stoppage, at a speed of 12 knots with 16 per cent. of grate and tube surface and 10 per cent. of cooling surface inoperative. The mean speed obtained of six runs on the measured mile with 1,000 tons deadweight on board was 12·109 knots, and on the straight course from Cullercoats Church to Newbiggin Church, which is certified by the Admiralty to be 9·6 knots, the speed obtained was 12·544 knots. The run of 9·6 knots north was made in 44 mim. 44 sec., and the run south in 47 min. 13 sec., giving a mean time of 45 min. 58 sec. The average speed, therefore, on the long and short runs was 12·326 knots, the contract speed being exceeded by one-third of a knot, which was considered by the owners and their officers to be very satisfactory. The engines, which are on the triple expansion, by the Wallsend Slipway and Engineering Company, Limited, worked during the six hours' trial with the greatest smoothness and without a hitch. The two steamers have been built to the order of Messrs. Huddart, Parker, and Co., Melbourn and Sydney, by Messrs. C. S. Swan & Hunter, Wallsend, and are of steel, classed 100 A1 at Lloyd's, and constructed to carry 3,500 tons cargo, 100 first-class and 80 second-class passengers.

Waverley.—On June 20th the handsome new saloon river passenger steamer, named the *Waverley*, which was recently built at Paisley by Messrs. M'Intyre and Co., had a preliminary cruise, prior to taking up her place for the season on the Kilmun route, as the companion to the *Meg Merrilies*. Her engines were supplied by Messrs. Hutson and Corbett, Glasgow. She measures 206 ft. by 22½ ft., and has a promenade deck extending over two-thirds of her length. Her sea-going qualities were thoroughly tested.

Sirius.—On June 21st the new-built first-class passenger steamer *Sirius*, built by the Flensburgh Shipbuilding Company for the Bergenske Dampskibs-Selskab in Bergen, had a very successful trial trip. She is intended for the route Drontheim to North Cape and back, for tourists, leading through the most seaworthy parts of the coast during the season of the midnight sun, May 11th to July 30th. This steamer is 202 ft. by 28 ft. 8 in. by 23 ft. 4 in. The engines are of 660 I.H.P., and make a speed of 12 knots. The passenger accommodation is fitted in a very luxurious style; the large saloon is fitted up with carved nutwood trusses and pilasters, panelling of polished maple, furniture, and piano of carved nutwood, all in the most tasteful and ornamental style. Under the upper deck is fitted berths to accommodate 88 first-class passengers, and 30 second class. On deck a teakhouse aft contains the companion, ornamented with flowers, a gentlemen's smoking-room, and a lovely boudoir for ladies. Everything has been done to make the trip as comfortable as possible for the passengers. The route leads mostly inside islands in smooth water, calling at different places with the most magnificent sceneries, as Torghatten, Lofoten, Tromso, Hammersfest, the northliest town in the world, North Cape, where the passengers are landed to ascend the Cape, famous sea fishing and shooting. The ship is constructed with a double bottom, all fore and aft, of malleable steel, in order to make the ship as safe as possible. In the winter time the *Sirius* will run as mail steamer between Hamburg, Bergen, and Vadso, calling at 90 places on each trip. For this purpose the midship berths are made to unship to give room for cargo.

Olinda.—On June 23rd the steamer *Olinda*, built by Messrs. Cochran & Co., of Birkenhead, for Messrs. Millward, Bradbury, and Co., of Liverpool, went on her trial trip. The start was made from the Liverpool landing stage at 12·45, and in spite of the unfavourable state of the weather a very satisfactory run was made to near the Bar ship and back, and thence to Eastham and back. The vessel is to be placed under the Brazilian flag, and the Brazilian Consul-General in Liverpool. The vessel ran her speed at the measured mile, and is now preparing to sail to Bahia, *viâ* Lagos.

Empress.—On June 24 the new twin-screw passenger and tug steamer *Empress*, built by Messrs. Cox & Co., Falmouth, for Captain P. Thomas, of the same port, had her official trial trip. She is 80 ft. by 15½ ft. by 8½ ft., and is fitted by her builders with two pairs of compound engines with cylinders 10 in. and 18 in. in diameter and 14 in. stroke, all the pumps being worked by an auxiliary engine with cylinders 7 in. in diameter, and steam being supplied at 90 lbs. pressure by a steel boiler 8 ft. 9 in. in diameter by 8 ft. 10 in. long. On trial her draughts were 4 ft. 4 in. forward and 5 ft. 10 in. aft, and displacement 80 tons. The collective mean indicated power being 168 H.P., and the speed 10½ knots.

Sternwheel Gunboat.—On June 24th one of the sternwheel gunboats, constructed by Mr. John Elder & Co., for Government service on the Nile, made a trial cruise on the Clyde. On the measured mile a speed of 11·3 miles per hour was attained. Opposite Toward Point a 9-pounder gun, which is placed on a revolving platform on the forward part of the upper deck, was tested. Ten rounds were fired at distances ranging from 40 to 2,400 yards, while 500 rounds were fired from a Nordenfeldt machine gun, which is capable of firing 800 rounds per minute. The test was considered highly satisfactory, as the vibration was very slight.

Indra.—On June 24th the powerful tug steamer *Indra*, lately built and engined by Mr. W. B. Thompson, Dundee, for towing purposes on the river Hooghly, and subsequently sold to the Government, had a trial trip on the Tay, on which occasion she was made use of by Vice-Admiral Hamilton and Captain Ruck, R.E., who had been deputed by the Government to make an inspection of that river with a view to its protection from a hostile invasion. The *Indra*, which is the most powerful tug steamer owned by the Government, measures 217½ ft. by 31 ft. 8 in. by 15½ ft. She has twin screws. Her engines, while going full speed, made 74 revolutions per minute, and a speed of 15½ knots per hour was attained. To prove the handiness of the vessel, she was repeatedly turned within her own length. About the middle of July she will proceed to Chatham, where she will be armed with 4-in. breechloading guns. When fully manned she will carry a crew of 250 men.

Steam Screw Launch.—On June 26, one of the twelve steam screw launches being built by Messrs. Barclay, Curle & Co., Whiteinch, for the Admiralty, went down the Clyde as far as Bowling on her trial. The twelve launches are alike, and measures 30 ft. over all, having a beam of 6 ft. 10 in. They are double planked, having an inside diagonal skin, and an external fore and aft run of planking about ⅜ inch thick each. They are fastened together with wrought copper nails and rooves, each boat holding about 8,000 of each. Internally the little crafts are well arranged, every corner being utilised. The boilers and engines have been supplied by the firm. The launches will be supplied by a couple of machine guns, each to work on a small platform fore and aft, and they are expected to reach a high rate of speed. The launch gave thorough satisfaction.

Richmond.—On June 26th, the steamer *Richmond*, built by Messrs. Gourlay Brothers & Co., Dundee, to the order of Mr. Bruce Baird Nicoll, Sydney, and lauched about a month ago, went down the river on her trail trip. The vessel left the harbour about 12 o'clock with a company of ladies and gentlemen on board, and steamed out as far as the Bell Rock. The *Richmond* is rigged as a topsail schooner, with pole masts. Her poop is covered in by a permanent teak shade deck, while the remainder of the deck is sheltered by awnings. The sanitary arrangements have been specially designed to meet the requirements of a warm climate. At the fore end of the poop are the officers' and engineers' rooms and kitchen. The forecastle, which is nearly 50 ft. in length, has accommodation for second class passengers; while the sailors' quarters are forward. A steam crane has been erected at the main hatch for working the cargo. The vessel will be steered by Bow and M'Lachlan's patent steering gear, and copper-topped lighthouse towers have been placed at the wings of the bridge. There is a flying bridge over the steam steering gear and captain's room, from which the vessel will be steered. The *Richmond* has been specially constructed to carry a comparitively large cargo on a light draught of water. She has water tanks fore and aft for trimming purposes, which will enable her to cross bar harbours on a level keel. There is accommodation on board for 68 first class and 38 second class passengers. The *Richmond* carries four large lifeboats. Her dimensions are as under:—Length between perpendiculars, 178 ft; breadth of beam, 27·7 ft; depth of hold, 10 ft. 6 in. She will carry 628 tons. Her engines, which are compound surface-condensing, have cylinders 23 in. and 46 in. in diameter, with 2 ft. 6 in. stroke. The boiler pressure is 100 lbs., and the engines are 105 N.H.P, with an indicated power of 600. The machinery worked very smoothly, and the vessel gave great satisfaction to all concerned. The speed of the vessel was tested, and found to be about 13 knots an hour.

Kathleen Mavourneen.—On June 27th the trial trip of the steel-paddle steamer *Kathleen Mavourneen*, built for the Drogheda Steampacket Company, took place. The vessel was launched by Messrs. Alexander Jack & Co., from their shipbuilding yard at Seacombe, on April 16th. She is 270 ft. long by 31 ft. 3 in. beam by 24 ft. 9 in., and is provided with double-compound oscillating engines of 2,000 I.H.P., with cylinders 47 in. and 85 in. diameter respectively, with a 6 ft. stoke, being supplied with steam of 85 lbs. pressure from two large steel boilers. It is anticipated that the vessel will attain a minimum speed of 18 miles an hour. She has a long full poop and promenade deck running the entire length of the ship. Sleeping accommodation is provided for 52 first-class passengers and 24 second-class passengers. The entire vessel is lighted by electricity. The vessel has five watertight bulkheads, constructed to insure safety in case of collision. She is schooner-rigged with two pole masts. The vessel is provided with a combined hand and steam steering gear, by Messrs. Harrison (Manchester), which is fitted close to the bridge and where the officer of the watch can "con" the course from his position on the bridge. There is also a wheel immediately above the rudder, so that in case of a breakdown of the steam-steering gear the vessel can be navigated from the poop. The 'tween decks, lower holds, and maindeck have been arranged with a view to the conveyance of cattle. The vessel started on her trial cruise from Liverpool landing-stage shortly after 11 o'clock, and proceeded down the river. Several stoppages took place in consequence of the heat of the bearings, but about an hour after the vessel had left the Bar Lightship an accident which occurred to the engines rendered it impossible for her to return under steam. The damage to the engine, though of a trifling nature, was not such as could then be repaired. A portion of the company on board returned to the New Brighton stage by a tug, and subsequently the *Kathleen Mavourneen* was towed back into the river.

Avocet.—On July 1st the steamer *Avocet*, built by Mr. W. B. Thompson, at Dundee, for the Cork Steamship Company, made a trial trip, showing a speed of over thirteen knots. The above vessel has been built to the highest class at Lloyd's, and is of the following dimensions:—Length between perpendiculars, 260 ft.; breadth, moulded, 34 ft.; and depth of hold, 15 ft. 8 in. She is intended primarily for the conveyance of cattle between London and the Continent, and with this view she has been built on the cellular bottom principle. The engines and boilers, which are from Mr. Thompson's Tay foundry, are placed well aft, this arrangement permitting of a better utilisation of the holds for carrying cattle, and, at the same time, ensuring good ventilation from the two large hatchways at each end of main hold. The poop extends to the fore end of boiler hatchways, and accommodation under the after end has been provided for officers and engineers, and on the poop deck a large number of sheep will be carried. The space under the bridge deck, amidships, is wholly occupied by the cabin, which is tastefully panelled in pitch pine, and contains roomy and comfortable quarters for the captain and first-class passengers. On the bridge deck is placed the wheel and chart-house, with entrance to saloon. In the wheel-house is placed Higginson's patent steam quartermaster, by which the vessel can be steered either by hand or steam, and from the wheel-house or from the flying bridge above. Under the forecastle is placed Harfield's steam windlass, for working the anchors. At the after end of this deck are placed two iron lighthouses, in which the ship's side-lights are fixed. This arrangement places the lights clear of all possible obstructions, and beyond all risk of extinction in the heaviest weather. The whole of the fore and main holds, fore, main, and after 'tween decks, and all the available space on main deck, has been fitted up for carrying cattle to the number of about 600. The engines, which are of the compound surface-condensing type, are of 187 nominal H.P., with cylinders 31 in. and 62 in., stroke 48 in., steam being supplied from one steel double-ended boiler, at a pressure of 90 lb., and from a donkey boiler for the cranes and winches.

Alert.—On July 8th the new screw steamer *Alert*, lately built by Messrs. John Fullerton & Co., Paisley, to the order of Mr. John T. Lane, of Guernsey, had her official trial trip on the Clyde. She is a vessel of 110 ft. by 19 ft. by 10 ft., and is fitted with a pair of compound engines of 50 H.P.N., by Mr. William Kemp, Govan. She ran the measured mile at Skelmorlie, in each direction with rather a heavy sea on, and attained a mean speed of 11¾ knots per hour.

Actor.—On July 10th the steamship *Actor*, which has been recently built by Messrs. Raylton, Dixon & Co., for Liverpool owners, left the Cleveland dockyard for her trial trip. She is built of steel, and her principal dimensions are 260 ft. over all by 34 ft. beam by 23 ft. depth of hold, and she has a deadweight carrying capacity of over 2,100 tons. She has bridge amidships for accommodation of officers, topgallant forecastle for crew, and deckhouse aft for accommodation of captain and a few passengers. Her cargo loading and discharging gear is unusually complete, and she is in every way fitted as a first-class merchant steamer. Her engines are on the triple-expansion principle by Messrs. Blair & Co., of Stockton, having boiler pressure of 160 lbs., and will indicate 700 H.P. She proved a success of this type of engines, warranting the expectation of great economy in the consumption of fuel. The ship and engines have been built under the inspection for the owners by Mr. Barrett and Mr. Cadman respectively. On her trial trip a speed of 11 knots was attained, everything working most satisfactorily, and the vessel subsequently proceeded to Liverpool.

Vaiturna.—On July 15th the steel screw steamer *Vaiturna*, built by the Grangemouth Dockyard Company, and engined by Messrs. Dunsmuir & Jackson, Glasgow, had her official trial trip on the Firth of Forth, rounding the Bass Rock and the May Island, and obtained a speed of 13 knots per hour. The steamer, which is intended for the passenger traffic at Bombay, measures 177 ft. over all by 26 ft. 6 in. by 17 ft. to the awning deck. She has been fitted with all the most recent improvements, including an electric light installation by Messrs. King, Brown & Co., Edinburgh. The engines have cylinders of 21 in. and 42 in. in diameter, respectively, with piston stroke of 30 in., and they are supplied with steam from a large steel boiler at a pressure of 115 lb. per square inch. They indicated 610 H.P. during the trial trip.

General Gordon.—On July 18th the *General Gordon*, a very handsome and completely equipped screw steamer, recently built and engined by Messrs. A. & J. Inglis, Glasgow, for the Dublin

and Glasgow Steam Packet Company, had her official trial trip. Being, so far as is known, the first Channel steamer fitted with triple expansion-engines, she marks a new departure in the company's history. The speed which she attained over a series of runs was equal to 14·508 knots per hour, the engines working with almost imperceptible vibration. The speed was considerably above guarantee, and it is believed to be greater than that of any other Channel steamer of her size.

Emilie.—On July 18th the trial trip of this steamer took place. The owners, Messrs. Burdick & Cook, of London, have introduced many special features into the vessel, which has been designed for a general cargo and passenger steamer. She will carry about 2,400 tons deadweight on a shallow draught of water, and has a long raised quarter deck, short raised poop, long bridge house, and topgallant forecastle; fitted with double bottom on the McIntyre principle, and coated with Day's patent cement. She has four very large hatchways, capable of admitting machinery and bulky cargo of the largest description, and as there are no beams in the holds, she has been constructed on the web frame and plate intercostal principle, which not only makes a stronger vessel, but allows large machinery, boilers, locomotives, torpedo boats, &c. to be admitted into the holds with the greatest facility. The booms, derricks, winches, &c., are of extra large size for lifting heavy weights. The engines were built by Messrs. Blair & Co., and are of the triple expansion type. During her runs over the measured mile they worked with remarkable smoothness, and the vessel attained a mean speed of 10¾ knots. The owners with a numerous company of friends were present during the trial trip, and partook of a substantial luncheon on board the vessel. "Success to the steamer," was proposed by the builders, and the owners in responding expressed their satisfaction as to the manner in which the ship and engines had been completed, and were especially gratified with the splendid and luxurious cabin and passenger accommodation, and with the painted panels which were fitted in the hardwood saloon. The company on board was as follows:—Messrs. Burdick & Cook; Mr. G. Blair and Mr. B. Blair, representing the engine builders; Captain King, Lloyd's surveyors, Mr. W. H. Loveridge, Mr. Woolley, &c.; Mr. R. W. Vick, Mr. C. Furness, and Mr. G. W. Sivewright represented the builders. After the trial trip the vessel proceeded to Antwerp, where she is chartered to load a cargo of large machinery.

Salamander.—On July 21st the screw yacht *Salamander*, which has just been built by Messrs. Schlesinger, Davis & Co., of Wallsend-on-Tyne, proceeded to sea for a preliminary trial trip. The dimensions of the yacht are as follows:—Length, 120 ft.; breadth, 20 ft.; depth, 10 ft. 6 in.; tonnage, 211 y.m. She has a sharp clipper stem, with an enlarged salamander for a figure-head, and a square yacht stern. A long deck-house is placed amidships, containing a deck saloon, and forward is another saloon, which will be arranged for the accommodation of ladies. The engines are of the Perkins' triple-expansion type, working at a pressure of 500 lbs. per square inch. The cylinders are 7¾ in., 15 13-16 in., and 22½ in. diameter by 15 in. stroke, and will work at about 140 revolutions per minute. After several trials on the mile the average speed obtained was nearly nine knots per hour. The *Salamander* is rigged as a topsail schooner, with sails by Messrs. Craven and Speeding Brothers, of Sunderland. On the deck-house is placed a steam steering engine by Messrs. Davis and Co., which during the trial worked smoothly and well. Harfield's direct-acting steam windlass is also placed forward. These auxiliary engines are supplied with steam from a generator in the engine-room. This generator is one of Mr. Perkins' patents, being a wrought-iron vessel containing a coil, through which a current of high-pressed steam passes, generating steam from the water outside the coil to 60 or 80 lbs pressure. The yacht has been built to the order of Mr. Frederick Power, of London, and after the trial proceeded to the Thames, being bound for the East India Docks.

Alacrity.—The *Alacrity*, a sister ship to the *Surprise*, recently ran her official trial with the following results:—Natural draught, four hours' trial; draught of water, 11 ft. 2 in. forward and 10 ft. 6 in. aft; steam in boilers, 92·63 lb.; vacuum, 26 in. and 25 in.; revolutions, 121 and 120 in the starboard and port engines; H.P., 1087 and 1070 horses in the two engines respectively, with a fuel consumption of 2·1 lb. per unit of H.P. developed. Speed, 16·143 knots. Four hours' forced draught trial, maximum air pressure in the stoke-holes, 1 in. by water gauge. Mean pressure in the boilers, 99·31 lb.; vacuum, 25·1 in. and 24·5 in.; revolutions, 134·87 and 134·75 per minute, the H.P. 1565·73 and 1607·34 in the starboard and port engines respectively. Fuel consumption, 2·77 lb. per H.P. per hour; speed, 17·956 knots.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

THE POSITION OF MARINE ENGINEERS.

To the Editor of The Marine Engineer.

Sir,—I have read several letters in your valuable journal under the above heading. I quite agree with your correspondent "T. C." that the engineer has a great future before him. And I maintain that it is equally as much importance to the ship-owner to have a good engineer on board his ship as it is a captain. And now when boilers of considerably higher pressures, and the triple-expansion engines are coming so much into vogue, as it is evident they will be the jobs of the future, there is equally as much responsibility attached to his position. And yet what a difference we find in the treatment between the captain and the engineer. And when any disagreement takes place between them, the one side of the story is taken for granted, and the other is never heard.

Now, if there is one grievance more than another that the engineer has to complain of, it is bad feeding—where you are not finding yourself—and I think that the majority of engineers will agree with me when I say that there are as many leave their ships on that account as anything else, and yet we seldom find an inquiry into the matter to know whether you are getting what is due to you; but the majority of owners will let an engineer that has served them well leave their service first. There is one more point where shipowners and superintendents are greatly at fault, and that is allowing the engine-room to be so short-handed; and, with the triple-expansion engines, where there is a saving of from 20 to 25 per cent. of coal, another man is knocked off in the stokehole. Now, I think that is a great mistake, as it is evident that, with boilers of so much higher pressures, considerably more care will have to be taken of them, and there is also more work in the engines. And I maintain that the present engine-room staff is not sufficient to keep up the efficiency of the boilers and machinery without help when at home ports, instead of informing you that you must have only so many hands on, as is now commonly the case. Hoping I have not taken up too much of your valuable space, I beg to remain, yours &c., Engineer.

Constantinople, *July* 21st, 1885.

FORMS OF SHIPS IN FUTURE WARFARE; HOW TO DRIVE, STEER, AND FIGHT THEM.

To the Editor of The Marine Engineer.

Dear Sir,—In time of war, when good men are scarce, and no time has to be lost—and every vessel may be liable to be short-handed in or after action—self-trimming hatchways, self-trimming bunkers, automatic steering gear, and ships that can beat over shoals without difficulty or danger of injury, must all be important factors in the hard struggle for maritime supremacy and bare existence. Every one acquainted with ships and ship-building, seamanship and navigation, must be well aware of the wear and tear in the life of a vessel, which must be aggravated in some vessels already too slightly built to begin with, and where the longitudinal strength that should tie them together is too much broken by interruptions of sheer, and large openings that cut in two the longitudinal tie above alluded to, and cause the vessels to vibrate, buckle and bend and break their sheer (a sure proof of weakness); and this is further extended by the vibration of heavy machinery driving the clumsy craft through heavy seas, overburdened with heavy cargoes in times of peace, and more so in times of war, with heavy and violent concussion of any firing of guns, the riddling with shot, and straining with additional pres-

sure of water in a leaky vessel. All these items of accumulating importance have to be well considered in the arming and suitably equipping of merchant cruisers, a perhaps more difficult question than the mere "State of the Royal Navy" to a maritime country like Great Britain with its numerous colonies, and more especially when the utmost speed, largest carrying power, smallest draught of water, extreme stability, liveliness, handiness, rapid turning, to avoid ramming, and easy steering, have all to be combined together in one vessel, that should also present as little mark as possible to the aim of the enemy. Top-heavy, revolving turrets, both wound the longitudinal tie, over-burden and expose the vital points to the aim of the enemy; and citadel batteries have the same objections, and would all be better, safer, and less conspicuous *below the upper decks, like sunken batteries* on shore. All deck-houses of any kind would be better as independent military block-houses, that when shot away would not injure the tie strength of the vessel, and would be more easily removed and replaced, or could be used as rafts, &c., for machine guns and loop-holed barracks, &c., on long, low transport vessels of light draught and extreme speed. The speedy supply of bunker coals is a question of public interest that, apparently, has been as yet unanswered, or worse still, only *officially attended to* (which means postponed until too late). The solution is as simple as A B C, or the fixing of Columbus's egg, viz., with *Gothic-arched triangular curved bunker hatchways, and hollow shoots for the coals to* the side bunkers in the bilges for automatic trimming to the stoke-holes, either in bulk, or sacks, or bags, that like "military sand-bags" would be a better defence than questionable armour plates, that, when fractured, become dangerous missiles, driving all before them to destruction—glad to supply the next urgent requirement of utilizing all existing muzzle-loading guns as converted breech-machine-loading guns of increased longer range and greater penetration.—Yours sincerely,

GEORGE FAWCUT.

9, *Rio dei Conservatori del, Mare, Genoa.*
June 16th, 1885.

From ANGIER BROTHERS' STEAM FREIGHT REPORT, July 25th, 1885.

FREIGHTS during the past fortnight have maintained the monotonous dulness which has so long characterised this and nearly every other trade. There has been a faint awakening in one or two quarters, but few transactions have resulted; and as to profit, little, if any, is looked for. The only consolation during this long strain on the endurance of those engaged in this anxious calling, is that the longer it lasts the more thoroughly is the cure being worked. EAST INDIAN FREIGHTS are still very depressed and low for homeward employment, but the coasting business in the China Seas maintains the late improvement, and keeps a fair number of steamers in work. Saigon to Hong Kong can still be done at 16 to 17 dollar cents per picul. Saigon to Manilla is quoted at 20 cents. Coolie and Pilgrim work promise fair employment. From BANGKOK 32/6 Rice is bid. From BURMAH as low as 31/3 and 30/ was taken for Europe, but for the India ports a better demand appears. Teak from MOULMEIN can still be had at low rates for Europe and Bombay—at 55/, 57/6, and 14-15 rupees respectively. The Conference rates are maintained for Tea from China to U.K. and U.S. From Calcutta there are one or two inquiries for August-September loading at 33/9 seed to Marseilles. MADRAS COAST offers 37/6 U.K. for September-October. BOMBAY and KURRACHEE freights are a dead letter. From PERSIAN GULF 30/ has been accepted. GRAIN FREIGHTS crept up 1½d. to 3d. per quarter in a few instances from DANUBE and BLACK SEA, &c., but after these fixtures orders failed. The trade from AMERICA, which at this season for August and September loading has for years been quite active, is at present quite dead; a fact which gives undoubted reality to the long-reported shortage in the American crops. COTTON FREIGHTS have now been secured for a respectable fleet of boats for September-October-November loading, but the rates accepted can at best only cover expenses. MEDITERRANEAN FREIGHTS offer desultory employment without a chance of profit. OUTWARD FREIGHTS, both berth and coal rates, are a shade firmer for the EAST, and the position of the market makes it a certainty that these must rise considerably if owners will desist from accepting losing figures.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from June 15th to July 11th, 1885.

7274 C. J. Wollaston. Signalling.
7287 J. Pickering. Boiler tubes.
7292 Barlow (J. H. Coevoet). Fishing and other nets.
7298 J. G. Davidson. Berths.
7301 L. J. Todd. Double-acting steam engines.
7302 G. Richardson. Life-saving hats.
7306 J. A. McMeikan. Ventilating.
7309 C. Wells. Actuating ship's fog horns.
7316 Reddie (D. S. Hines, W. A. Perry & C. G. Worthington). Direct-acting engines.
7328 Johnson (N. J. V. Cadiat). Steam generators for marine engines.
7333 C. W. Hunt. Dredging or grab buckets.
7340 J. Scott. Governors for steam engines.
7376 C. D. Yates. Water boilers.
7388 A. Brown. Hopper dredgers.
7408 H. MacColl. Coupling shafts.
7421 R. S. Boyer. Steam boilers.
7431 Mills (L. Dasart). Lubricating.
7435 H. J. C. Keymer. Propelling small ships.
7441 Allison (W. Robarts). Raising water.
7442 Boult (P. Macabies). Lubricators
7444 H. Turner. Compound steam engines with three cylinders.
7446 P. A. Maignen. Water softening process.
7474 J. Dawson & G. A. Senior. Valves.
7490 M. Lohmann & M. Stolterfoht. Couplings for shafts.
7543 R. Hudson. Lids for powder magazines.
7544 J. W. McFarlane. Governors for steam engines.
7545 W. H. Harfield & W. Eames. Ships' riding bitts.
7551 C. B. C. & S. O. C. Coles. Steering ships
7566 S. H. Sparkes. Stuffing boxes for piston rods.
7568 Lake (G. V. Fosberry). Gunbarrels.
7575 J. Ackerley & B. Parr. Method for taking soundings.
7594 W. Campbell, sen. Preventing priming in steam boilers.
7599 S. W. Smith. Metal cocks or taps.
7614 J. Donaldson. Detaching apparatus for boats and vessels.
7628 R. Williams. Screw Propellers.
7629 G. B. Hingley & J. R. Curry. Anchors.
7636 W. Tice & C. Armstrong. Protective appliances for military and naval purposes.
7640 Boult (W. F. Wolff & M. de Förster). Charging hollow projectiles with compressed granular explosive substances.
7641 G. S. Strong. Steam engines.
7659 H. Job. Mariner's compass.
7660 J. Bovey. Bathing platform for use with boats.
7661 J. Hay & R. Wylie. Light feed lubricators.
7677 H. Thompson. Furnaces for steam boilers.
7690 W. H. Hall. Means for propelling boats with oars.
7696 W. J. Mackenzie. Flexible couplings for shafts.
7697 M. Campbell. Metallic packing device for the pistons of steam engines.
7711 J. F. Hall & J. Verity. Couplings for screw propeller.
7713 C. Stout. Hydraulic steering engines.
7774 G. Salter & H. Ault. Combined pressure and vacuum gauges.
7792 E. Davies & T. Smith. Compound engines.
7798 P. G. G. Westmacott. Facilitating the hoisting in and out of heavy boats.
7809 R. Stewart. Coverings of steam boilers.
7837 Clark (M. Honigmann). Producing steam at high pressure.
7838 S. M. Cockburn. Rotary steam and other fluid pressure engines.
7851 Budenberg (Schäffer & Budenberg). Steam traps.
7874 M. Wyatt, jun. Defence against attack by torpedoes.
7877 G. F. Pottle. Valves.
7890 Wilding (H. Schoening). Sounding device.
7891 G. A. Goodwin & W. F. How. Nut-locking device.
7909 L. B. Carricaburn. Steam engines.
7919 Colton (F. W. Jenkins). Actuating the valves of direct-acting engines.
7925 Justice (the Peerless Oil Ejector Company). Lubricators.
7934 T. Hunt. Steam engines.
7939 E. F. Piers. Governing the speed of engines subject of variable work.
7940 E. F. Piers. Governing the speed of engines subject of variable work.

7945 A. S. Lyman. Cartridges for small arms.
7946 A. S. Lyman. Cartridges for ordinance.
7949 Boult (H. Sewrey) Rotary engines
7990 E. Brearley. Light-feed lubricator.
7996 J. S. Raworth. Apparatus for indicating distances tarvelled by ships.
7997 Edwards (O. Bomnitz) Boilers.
8010 J. N. Paxman. Automatic expansion valve gear for steam engines.
8027 T. Drake. Heating water and generating steam.
8077 D. W. C. Piggott. Net sails.
8111 S. Snell & G. Pearce. Ship, stable, and other globe lamps.
8117 W. Harvie. Construction of lanthorns for ships' anchor.
8119 G. R. Allfrey. Construction and working of compound marine engines.
8132 A. D. Bryce-Douglas. Link motion for working the slides of valves of steam engines.
8133 C. J. Galloway & J. H. Beckwith. Thinning corners of boiler and other plates.
8135 C. J. Galloway & J. H. Beckwith. Drilling holes in sides of cylinders.
8136 M. R. Ward. Torpedoes.
8154 A. W. P. Ross. Course and position finders.
8174 T. Lishman. Steam boilers or steam generators.
8187 R. Wyllie & D. B. Morison. Supplying heated air to marine boiler and other furnaces.
8207 Thompson (J. B. Erwin). Steam taps.
8215 L. B. Carricaburn. Duplex steam engines.
8216 L. B. Carricaburn. Valve gear for duplex steam engines.
8218 C. Wells. Construction of projectiles.
8227 T. H. White & R. G. Brooke. Cocks and valves.
8236 O. Jones. Machine guns.
8239 Clark (B. F. Wright). Steam boilers.
8271 A. J. Needham. Breech-loading and repeating fire arms.
8281 H. S. Maxim. Machine and other guns.
8286 R. Barnard & E. Miles. Tube expander.
8292 E. J. Eyres. Steam Windlasses.
8296 E J. Eyres. Ships' riding bitts.
8297 Barlow (J. Oeschger, fils & G. Morel). Rotary steam engine.
8298 E. J. Eyres. Anchor capstans.
8305 R. Whitehead. Rotary engine.
8317 E. P. Clayson. Armour plating ships.
8327 Myall (W. Judd). Keeping clean the bottoms of ships.
8330 S. Butler. Motive power engines.
8343 D. R. Dawson. Explosive projectiles.
8344 M. Jones. Pump and circulating valves.
8354 W. S. Gardner & A. H. Sheppard. Self-acting valve.
8371 A. Brown. Hopper dredgers.
8380 F. N. Mackay. Floats for regulating the motion of valves.
8426 E. C. Peck. Locomotive torpedoes.
8433 R. Evans. Marine Chronometers.
8435 J. C. Brentnall. Furnaces for steam generators.
8439 P. Baylis. Slide valves for steam engines.
8441 G. A. Calvert. Screw propellers for ships.
8461 A. J. Cooper & E. E. Wigzell. Instruments for taking soundings.
8465 Prince (H. J. E. Heunebutte). Utilisation of the motive power of steam.
8479 G. Wilson. Safety valves.
8484 A. H. Emery. Sheathing,
8493 R. T. Bells. Feathering apparatus for screw propellers.
8494 R. Morrin. Steering gear for use when the rudder stock is broken.
8497 J. Thom. Steam engines.
8506 H. See. Crank shafts and bearings.
8511 J. Lea & R. Matthews. Signalling on board ship
8546 S. Tebbutt. Measuring indicators.
8562 A. T. Allen & H. Cavill. Construction of springs for pistons.
8586 W. P. Branson. Ships' propellers.
8593 W. Hill. Automatic lubricator.
1603 G. Temple & W. Rowntree. Pistons.
8614 Kuhne (R Proell). Valves of steam engines.
8615 R. Kullig. Royle's condensation apparatus.
8624 J. Hooker. Apparatus for gauging the depth of water.
8637 J. Westaway. Vessels for keeping fish.
8645 J. & G. W. Stroud. Valves.
8647 J. Engelson. Motive power engines.
8653 C. F. Swan. Ships' binnacles.
8699 C. A. Moreing & P. Tarbutt. Utilising exhaust steam.
8700 J. Brockie & M. W. W. Mackie. Rotary engine.
8701 H. De Burgh Lawson. Iron-clad vessels.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

June 20th, 1885.

Blackburn, Thos. 2C Greenock
Candlish, J. J. .. 2C Snderland
Cardigan, A..... 1C Liverpool
Davidson, D..... 2C Dundee
Derbyshire, R. .. 1C Liverpool
Fanning, F. .... 2C Snderland
Garbutt, James.. 1C ,,
Grant, George ... 1C Liverpool
Harrison, Hy. S. 2C Snderland
Hastings, Wm... 2C Cardiff
Haworth, Frank. 1C Liverpool
Hume, John .... 2C Dundee
Hutchison, G. W. 2C Snderland
Kirkpatrick, J. R. 1C ,,
Lennox, D. J. .. 1C ,,
Machan, Samuel. 2C Dundee
McLellan, George 2C Liverpool
Palmer, Richard. 2C Snderland
Pritchard, E..... 2C Dundee
Quillish, Wm. .. 2C Liverpool
Sharples, A. E... 2C ,,
Smith, Charles .. 2C Dundee
Steel, John...... 1C Liverpool
Webster, F. D... 2C Snderland
White, Edward.. 1C ,,
Smith, Thomas.. 2C Leith
Thomas, Edward 1C London
Waugh, Geo. W. 2C N Shields
Wymer, Fra. D. 2C London

June 27th, 1885.

Besant, George.. 2C Bristol
Cameron, J. D... 1C Aberdeen
Cameron, W. A.. 1C N Shields
Clarke, Geo. E... 2C Liverpool
Cornelius, E. J... 1C London
Dawson, Thomas 1C Hull
Dunlop, John .. 1C London
Fraser, James .. 1C ,,
Fraser, James .. 2C Liverpool
Gibson, Matthew 1C Belfast
Kjelgaard, J. C. W. 1C N Shields
Manson, George. 2C London
Martin, F. H. .. 2C Liverpool
McQuade, Samuel 1C Belfast
McReavie, Sam'l 2C ,,
Morrison, Wm... E1C Glasgow
Phillips, Thomas 2C London
Thom, John .... 1C ,,
Torrance, John.. 2C N Shields
Wilson, Archibald 2C Glasgow
Wyllie, William. 2C Hull
Young, David .. 2C London

July 4th, 1885.

Alexander, W. C. 1C Leith
Bushbye, A. .... 1C N Shields
Campbell, Robert 1C Glasgow
Dodds, William.. 2C Leith
Douglas, George. 2C ,,
Fairweather, J. H. 1C Leith
Gosling, Ernest. 1C Liverpool
Hart, Charles.... 1C London
Hook, Fredk. E.. 1C Liverpool
Johnson, Alex. A. 2C Glasgow
Johnson, F. .... 2C N Shields
Lawrie, Peter.. 1C Leith
MacCulloch, R.G. 1C Glasgow
Macintyre, Peter 2C ,,
McLean, David D. 2C Liverpool
McPhee, Daniel. 2C London
Napier, George.. 2C Leith

July 11th, 1885.

Andrew, R bt. C. E1C Dundee
Bace, H. W. .... 2C Liverpool
Banks, F. W..... 2C N Shields
Brown, Hugh .. 1C Greenock
Brown, James .. 2C N Shields
Carter, Wm. H.. 2C Liverpool
Coulson, T. A. .. 2C London
Forbes, W. M. .. 2C Greenock
Fullerton, Alex.. 2C Leith
Heppell, Wm. .. 2C N Shields
Maddison, John.. 1C ,,
Ritchie, David .. 2C Liverpool
Robertson, Henry 2C Leith
Sandeman, Alex. 2C London
Shaw, J. H. S. .. 2C N Shields
Shirreff, Wm. .. 2C Greenock
Taylor, John.... 1C N Shields
Walker, Archibald 2C Greenock
Watson, Wm. .. 1C Liverpool
Worthington, P.. 1C ,,

July 18th, 1885.

Bissett, Joseph .. 1C Hull
Cameron, Duncan 1C Glasgow
Campbell, John.. 2C ,,
Campbell, R..... 1C Liverpool
Cowing, Matthew 1C N Shields
Curragh, W. J... 2C Dublin
Denholm, Alex.. 2C Glasgow
Dickinson, P. E.. 1C Hull
Dunn, Peter .... 1C W Hartpl
Eccles, John ..... 2C Glasgow
Edwards, J. A... 2C Hull
Elliott, A. ...... 1C London
Ewan, James.... 1C Glasgow
Fitzsimon, M.... 1C Dublin
Gamble, E. G. ... 2C London
Garner, G. H. .. 2C ,,
Graham, J. W.... 1C Glasgow
Grant, John .... 2C ,,
Hedderwick, P.. 1C ,,
Henry, Alex..... 1C Greenock
Horan, William.. 1C Glasgow
Kydd, Alex. ...... 1C ,,
Liversidge, J. H. G 1C Hull
Love, Robert.... 2C Glasgow
Lynas, Michael.. 1C Liverpool
Mackay, D. ..... 2C London
Nash, Alfred.... 2C W Hartpl
Parkin, W. T. .. 1C Hull
Paterson, Wm... 2C W Hartpl
Paton, A. R..... 2C Glasgow
Pease, Alfred..... 2C W Hartpl
Pettigrew, Thos.. 2C Glasgow
Potts, William .. 2C N Shields
Proud, Joseph .... 2C W Hartpl
Reddie, Robert.. 2C Glasgow
Smith, William... 2C Liverpool
Struthers, W..... 1C Glasgow
Swinnerton, J.... 2C Liverpool
Thom, Robert.... 1C ,,
Temperton, F. W. 2C London
Trechmann, J. E. 2C W Hartpl
Wallace, R. H .. 1C Glasgow

The Marine Engineer.

LONDON, SEPTEMBER 1, 1885.

EDITORIAL NOTES.

AN important step, as affecting the rules of construction of iron and steel mercantile vessels of the future, has now been completed. The Liverpool Underwriters' Registry for iron vessels has at last been absorbed into and amalgamated with Lloyd's Register, apparently on very fair and suitable terms, as regards the vessels now taken over. This arrangement cannot but give an access of authority to the Lloyd's Registry, and a better position to those vessels which have now been transferred to it. There is only one serious doubt that may arise as to the general benefit of the arrangement, and which we think is likely to be present to the minds of many who have hitherto pinned their faith to the Liverpool Registry. The doubt is this: that hitherto the Liverpool Registry has been the most influential leader of opposition to many of the technical engineering rules and scantlings of the Lloyd's staff of surveyors. Under these circumstances, and since that opposition has ceased to exist, may not the surviving body become more and more harshly arbitrary in their rules and dogmas, which in many cases may not meet with the approval of the shipping world at large? Some little danger may result from this, but the actual effect for good or for evil will depend almost entirely upon the action of Lloyd's Registry in keeping pace with the times, and the constant improvements that are being made in the design and structure of commercial steel and iron vessels. There is not nearly the same danger of the views of the now sole remaining arbitrating body, as to correct design and structure of vessels, being narrow and incompetent, as might have been the case some 20 or 30 years ago. The present chiefs upon the staff of Lloyd's surveyors have latterly signalised themselves most admirably in the active part they have taken in the tabulation of results, and in scientific discussions of all the latest improvements, both in material and structure, that have lately been introduced into the construction of our mercantile marine. Mild steel would never have taken its present honoured and secure position in marine construction, without the careful research and compilation of results, so constantly published at scientific meetings by Mr. Parker, for which his official position gave him exceptional opportunity. A much graver responsibility now, however, devolves upon Lloyd's surveying staff than hitherto, inasmuch as the cessation of all practical rivalry leaves them sole arbitrators as to rules, regulations, and scantlings of mercantile shipping, the exigencies of modern insurance practically throwing the whole of our mercantile marine under their sway. Such an irresponsible monopoly of power is a very dangerous thing, and we trust that their future action will be rather to lead than to hamper shipbuilders and marine engineers in improvements and modifications which from time to time must arise in the hulls, boilers, and engines of our mercantile marine, to enable us to keep our present prominent position in the carrying trade of the world.

THE natural result of the refusal of the new American Secretary of the Navy to accept the *Dolphin* and the other unfinished cruisers made or in process of building by Mr. John Roach, has been his bankruptcy. This is infinitely a more serious matter than the mere closing of a shipbuilding yard, inasmuch as the works of Mr. John Roach were the only ones in the States capable of turning out iron vessels of any size. His bankruptcy, therefore, means the total cessation for the present of all iron shipbuilding in the United States. For some years Mr. Roach's production has been on the average at the rate of seven ships a year, with an average tonnage of between 14,000 and 15,000 tons per annum. It would appear by his failure that the heavy subsidies, protective duties, and restrictive navigation laws, which prevent Americans from owning foreign built ships, have all failed in maintaining iron shipbuilding as a commercial speculation in the States. In fact, it appears that John Roach has been simply kept on his feet by the exorbitant price paid to him on account of the Navy Department for repairs and other work from time to time, in which he was generally the favourite contractor, owing to his intimacy with the Naval Department. This intimacy and influence came to an end with the accession of President Cleveland last March, and the immediate consequence has been Roach's financial collapse. Had he been making anything like the money with which he was credited during his former years of jobbery and prosperity, the present hitch with his Government contracts could scarcely seriously have crippled him, were the vessels anything like serviceable and seaworthy when completed. The Americans have been learning during the last few years a very serious lesson. As far back as 1855 over 75 per cent. of American commerce was carried in American bottoms. Ten years later, at the close of the Civil War in 1865, the proportion was reduced to about 10 per cent. This was but a natural consequence of the

absorption of money and attention, and consequent hindrance of business by the Civil War. But there has been a lamentable want of energy on the part of the American Administration since, in endeavouring to retrieve lost time. Their only effort in this direction has been that of protection of what they considered the interests of the home manufacturing industry of iron vessels, principally represented by John Roach. This has naturally resulted in the absolute discouragement of all American shipping and shipowners, with the melancholy result that she is hardly represented at all as a carrying nation. As the States are eminently well situated, and provided with harbours for conducting a large shipping traffic, and possess also a hardy seacoast population suitable for manning American vessels, the failure of John Roach may have the most beneficial effects in teaching the Americans not to drop the bone of maritime commerce by endeavouring to grasp the shadow of a protected industry.

THE agitation commenced under the auspices of Mr. Chamberlain for fresh legislation against shipowners, to protect the lives of seamen, has so far practically collapsed, that it has resulted merely in the appointment of a Royal Commission to take evidence, and ascertain whether the very serious statements put forward by the promoters of the Bill and Mr. Chamberlain are substantiated or not by facts. Upon an examination of the evidence tendered by the Board of Trade in support of their case, which is now complete, there can be little doubt, we think, to unprejudiced minds, that there is much that is open to doubt. Mr. Chamberlaim seems to have based most of his agitation upon his view that—"The loss of life is higher than the loss in any other trade whatever, and therefore calls urgently for legislative remedy."

Now, we fear that a very reasonable objection at the outset to this wide deduction, is the point of view that it is well known and accepted that the risks to life at sea are greater, by reason of natural causes, than the risks to those whose occupation is on land, except, perhaps, in the case of one or two dangerous trades. For Mr. Chamberlain to remove these risks by "legislative remedy" it would seem that he must bring the wind and the waves under the control and rule of Britannia, which has hitherto usually been considered as a more poetical than practical expression. Or that he must, at least, by "legislation" produce a vessel which is incapable of foundering, of which the engines will never break down, or boilers burst, and which shall be capable of any number of collisions or strandings without permanent injury to the hull. Such results may possibly be gradually approximated to by the march of successive improvements; but we do not think that any reasonable man would expect "legislation" to succeed in effecting them. The question then resolves itself into whether "legislation" can define in what way such protection from risk can in any way be partially realised. One of the greatest points insisted upon by the Board of Trade was the increased percentages of deaths at sea as compared with former eras in our history. It seems that these figures even are open to very grave question, owing to the altered constitution of the crews now generally employed, of which a large number of Lascars and other aliens form part. These, it is believed, have been entirely omitted in the estimation presented by the Board of Trade in the total number of seamen employed, which will thus materially affect the percentage; but beyond all this, even were an increased percentage of loss to be proved to now exist as compared with former years, surely these are very largely accounted for by the constantly increasing number of vessels frequenting the much-used seas, and the higher speeds at which they run? These causes will all concur in largely increasing the percentage of collisions, which is at present accepted to be the most fruitful source of disaster. It would be but sorry "legislation" for the nation at large, were it attempted to reduce these obvious risks by the enforced reduction of speed or diminution of traffic. Short of such drastic remedies, it is difficult to see how "legislation" pure and simple can prevent even a considerable increase of loss of life at sea.

AT last the long continued battle over the Manchester Ship Canal bill has ended in favour of the scheme. Manchester is therefore now in a fair way of being placed in direct communication with the sea, as it is scarcely likely that the promoters should have spent the enormous sum of money laid out in getting the bill through Parliament unless they see their way financially to complete the scheme. Altogether 173 sittings were held by the Lords and Commons' committees before the present conclusion had been arrived at, and the bill had been rejected once by the Lords when passed by the Commons, and once by the Commons when passed by Lords, before the present unanimity had been arrived at. The Canal now sanctioned by Parliament is thus described by the promoters:—"The proposed Manchester Ship Canal is a scheme for the conveyance of ocean going vessels from the sea direct into the heart of Cottonopolis." The Canal will be 35 miles long, and will impound

the water by a series of locks. After leaving the city it will pass through the outer basins of the Mersey and Irwell Navigation Co. above Runcorn, and be thence continued along the Runcorn shore, across the mouth of the river Weaver into the Frodsham Marshes. It will thence skirt the shore near Ince and pass inland across Stanlow Point, until it reaches Eastham Ferry, where it enters the river in deep water. The docks will allow steamers of large size to load and unload at their quays, 26 ft. depth of water being maintained throughout. The Canal will be faced with stone in all cases, and be lighted and buoyed where necessary, to enable vessels to pass either up or down any hour of the day or night, and at any state of the tides. Every precaution seems to have been taken by the committee that no injury shall be effected by the canal to the existing waterway or harbour accommodation of the Upper Mersey. The clause for the protection of the Mersey has been made to read thus :—If any work executed by the Company shall at any time, in the opinion of the Mersey Commissioners, cause any injury to the Estuary, or to any of the approaches thereto, or to the bar, or prejudicially affect any anchorage, mooring ground, or landing stage within the jurisdiction of the Mersey Commissioners, or the access to any dock, or in any way cause injury to the navigation, or to the due working of any ferry within that jurisdiction, then, and in every case, the Commissioners shall have power—notwithstanding any approval by them of such work—to order the Company to take such steps as may appear to the said Commissioners reasonable or proper for preventing or remedying any such prejudicial effect as aforesaid.

Centrifugal pumps now form an essential part of the pumping or circulating arrangements of many steamships. Our readers will therefore probably be interested in the results of a trial brought by Messrs. John and Henry Gwynne, the well-known centrifugal pump makers, to support their claims to improvements in centrifugal pumps, having for their object the swivelling of the suction and discharge pipes of the said pumps. The alleged infringers were Messrs. Drysdale & Co., of Glasgow, who had effected latterly certain improvements in centrifugal pumps made by them which fulfilled the same purpose of enabling the suction and delivery to be swivelled as desired, but with a slightly different means to that patented by Messrs. Gwynne. The defenders pleaded that the letters patent founded on were null and void in respect (1) that the alleged invention was publicly known as used prior to the date of the letters patent ; (2) that the invention was of no practical utility. Their defence, curiously enough, fell through on both these points, the judge, with whom an assessor was joined, giving it as their joint opinion that Messrs. Gwynne's invention had not been anticipated, and was of sufficient practical importance to be patentable matter. One would have thought, after this apparent lapse of the defence, that Messrs. Drysdale & Co. would have been out of court, but far from it. The judge and the assessor again jointly found that Messrs. Drysdale & Co. had not infringed the patent—evidently a plea which Messrs. Drysdale & Co. had not themselves dared to put forward. Messrs. Drysdale & Co. therefore won the action, which was dismissed with expenses. This is, to say the least, a very curious judgment, as since Messrs. Gwynne claim the swivelling action as a whole, either their claim was too wide, and the patent should therefore have been voided, subject to disclaimer, or the means by which the swivelling action was carried out, which was the sole difference between the two arrangements, was a detail of no importance, and did not confer immunity from infringement. We should hardly imagine that this action will end in this unsatisfactory way, as otherwise it will form another illegal patent decision.

YARROW'S TORPEDO BOATS.

It was in 1877, on the breaking out of the war between Turkey and Russia, that the torpedo boat first came prominently before the public as a possible powerful factor in the waging of maritime war. About that date, Russia determined on constructing one hundred of these vessels for despatch to the Black Sea and adjacent ports, and for the especial benefit of the Turkish fleet in those waters. They were to be of the smallest possible size, suitable for keeping the sea for a few days, and built in such a way that they could be transferred by railway from the Baltic to the southern parts of the empire. Under such conditions it was determined to make them 75 ft. long and 10 ft. beam. They were contracted for by seven different firms, five of them being in Russia, and the greatest number were supplied by the Baltic Engineering and Shipbuilding Company, of St. Petersburg.

Messrs. Yarrow & Co., of London, who had for many years previously been engaged in the building of fast steam launches for river service, which had attracted the notice of the Russian Government, received orders for as many sets of machinery as they could get ready before the closing of the Baltic by ice, and were requested to furnish the working drawings of machinery and hulls, from which a large number of these vessels could be immediately put in hand in Russia. In November of 1877, the first trial of the first boat took place upon the Neva, from which was obtained a speed of 18 knots. The completion of the others followed in rapid succession, and most of them were forwarded at once to Sebastopol by railway, their funnels being the only part of them which it was found necessary to remove for facility in passing through tunnels and under bridges. The greatest aggregate weight was 20 tons, and they occupied seven days in transport. Immediately on being launched in the Black Sea they were tried under steam, and gave the highest satisfaction to the authorities.

They also were found to possess much better bad weather qualities than had been feared by their crews. They had an impression, along with many people in this country, that being so very fine at each end, and so very sharp in model, that they would be bad sea boats, an idea which has been totally refuted by the performances of many ocean steamers and steam yachts, as well as

torpedo boats. Very soon after this, the British Government ordered a number of first-class vessels of the above dimensions, and early in 1878 another order was given to various firms.

In the spring of 1879 there was a trial of speed at Long Reach, in the Thames, in which the greatest speed reached was 21·94 knots an hour, and the lowest speed being 19 knots. The successful and fastest ship was built by Messrs. Yarrow & Co., and accomplished, practically, three knots an hour over and above all others. The load carried during that trial was 6¾ tons, representing torpedoes, all gear of various kinds, and coals.

It is said this boat still maintains her position for speed as the fastest in the navy. Yarrow & Co. fitted to this vessel, some little time after she had been launched, an improved rudder—carried in the keel about one-fourth the vessel's length from the fore-foot—which had the effect of very much improving her manœuvering capabilities. In making the circle, with this rudder assisting the after rudder, the diameter was reduced, under port helm, from 214 yards to 94, and under starboard helm, from 178 yards to 120. The result was, indeed such, that the Admiralty and other foreign governments adopted this auxiliary rudder in all following constructions. In 1878, Yarrow & Co. built two boats for the Russians, which on account of the war, were not allowed to leave the country, and which subsequently passed into the hands of our Government. During an official trial of one of these boats, an accident occurred in the rupture of a boiler tube, which is one of the great dangers which the engineers who drive such vessels have to guard against. The builders, with an anticipation of such danger, had guarded against loss of life by an arrangement of valves, which should close immediately an accident occurred, and thus cut off all communication between the boiler and stoke room. On the occurrence of the accident, and complete immunity of engineers and stokers from danger, instructions were issued by the Admiralty to fit all other boats in the same manner when working under a forced draught. This salutary system not only preserves life when such an accident happens, but gives the engineers and stokers increased confidence in driving the boat to her utmost capacity. In 1879 the Russian Government contracted with Messrs. Yarrow & Co. to advance a step in torpedo boat building, and to turn out a vessel which should not only keep the sea in all weathers, but make the ocean passage, under steam, to her destination in the Black Sea. She was to be a torpedo cruiser according to the ideas of that date, and was to be able to run a distance of 800 miles at a moderate rate of speed. She was to be 100 ft. long, and have 2 ft. 6 in. more beam than others which had, up to that time, been built; was to have engines indicating 500 H.P., and to be adapted for carrying four fish torpedoes, to be passed through the conning tower into two launching tubes supplied by Mr. Whitehead.

They were placed side by side in the centre of the vessel, and projected just outside her bow. She was fitted with three short masts and sails, as a precautionary measure against the failure of the engines or the supply of coals running short. This vessel left England in August, 1880, with a crew of three officers and nine men, and steamed 4,800 miles, in 18 days, to the Black Sea, being an average of 11 knots an hour. By the terms of the contract she was to steam 20·5 knots per hour at a light draught of water, and agreeably surprised all parties by an actual performance of 22 knots on the measured mile, and without any tide influence in her favour. This was, perhaps, one of the greatest triumphs onnected with marine engineering, and established the reputation of Messrs. Yarrow & Co. as builders and engineers of the fastest sea-going torpedo boats in the world. The performances of this "little wonder," the *Batoum*, during her voyage out to the Black Sea, her trials at Fiume on the way out, and her subsequent record in Russian waters, opened the eyes of foreign governments to a new and formidable power which they would have to calculate on in all future naval wars. She had not accomplished much as a destroyer of navies, but all observers could see she was a factor in naval warfare whose very presence alone would guide and compel an obstinate policy.

The result of her existence in the Black Sea was that the British, Argentine, Greek, Brazilian, Austrian, Dutch, and Italian Governments were not slow in availing themselves of the services of Messrs. Yarrow & Co., her builders and engineers, and from that time to the present this firm has been going on steadily furnishing the world with new and improved types of sea-going torpedo cruisers. Before the *Batoum* left the Thames some interesting experiments were made with her to test the reduction of speed due to increased displacement, and it was found that up to 15 tons of a load, there was a diminution of speed at the rate of one-fifth of a knot per ton or for every inch of immersion a lossof nearly four-tenths of a knot per hour. (For illustrations, see pp. 154, 155.)

The fish torpedoes, which these vessels carried in side davits when they were first constructed, was considered, in many cases, to have objectionable features, principally in the lowering process, which necessitated the stopping of the boats and other serious delays, which were of a vital character to the success of their movements. In order to introduce a more efficient system for discharging the torpedoes, Messrs. Yarrow introduced the "temporary steam impulse gear," which, on trial before the Admiralty authorities, induced them to have all future vessels fitted with it. This consisted in building in the forward part of the boat two troughs, in which the fish torpedoes lie side by side. Immediately behind them, and under a steel covering, are a couple of "impulse tubes," consisting of two steel cylinders, whose piston rods press against the after end of the torpedoes. Thus, at the will of the officer in charge, either one or both the torpedoes can be suddenly and forcibly ejected without requiring any reduction in the speed of the boat, or the presence of any member of the crew, who may all remain under cover. This was an immense and important improvement upon the davit and lowering system. About this time the Admiralty gave an order for 34 second-class boats for equipment to the large ironclads, and out of this flotilla the highest speed obtained was 17·27 knots per hour during a continuous run of two hours. This vessel was built by the Yarrow Co.

About this time a collision in the Bay of Spezia occurred between torpedo boats, when one vessel ran completely through the bows of the other with her sharp pointed beak stem. The boats were running at a speed of 14 knots, which was reduced to about 10, perhaps, at the instant of collision. They were saved from sinking by their own bulkheads, and both steamed into harbour without further trouble. The vessel run into was one of Yarrow's, and was repaired by the Italian Government in a week, after which she went on doing well. Although the collision took place with such force, she sustained no other damage further than being pierced.

On the 13th December, 1881, this firm built No. 535 for the Italian Government, and during her trials of speed on that date, at Long Reach, the following means of six runs were obtained:—Steam on boilers, 116·5 lbs.; pressure in receiver, 35·5; vacuum, 25·5; revolutions per minute, 480; mean of speed, 22·46 knots. The greatest speed obtained was on the sixth run, being actually 24·324; and the smallest speed on the fifth run, being 21·301 knots. This vessel was 100 ft. long and 12 ft. 5 in. beam. The trial was attended by Rear-Admiral Racchia, the present Admiral Noce, and Chief Engineer Nagar, of the Italian Navy. Her draught forward was 2 ft. 3 in., and aft 3 ft. 6 in.; propeller, two bladed, 4 ft. 7 in. diameter, and 6 ft. pitch. The load carried was 3 tons 13 cwt.

The boats built by this firm for the Brazilian Government were 110 ft. long and 12 ft. 6 in. beam. They (four in number) were navigated to Rio under sail alone, their propellers being removed and false keels attached to give them better sailing capacity. These vessels were, by the terms of the contract, to have had a speed of 18 knots, during a continuous run of three hours, and a weight of 12½ tons, representing their fully equipped state when going into action. In the trial of the four boats 20·3 knots were obtained, which is possibly the highest speed officially recorded under such conditions of time, and weight carried. Since these trials, it is doubtful if any improvements in torpedo speed and construction have been made, at least nothing very appreciable. The equally well-known firm of Messrs. Thornicroft & Co., and that of Messrs. M. Normand, had constructed two boats for the Russians. Thornicroft's, it is alleged, was 113 ft. long and 12½ beam. She did 18·96 knots per hour during a run of three hours' duration. Normand's boat was 124 ft. by 11 ft. 8 in. During a run of three hours she did 18·5 knots, but it is claimed that she only burnt, during the three hours' trial, 1 ton 19 cwt. of coal, against 2 tons 19 cwt. burnt by Thornicroft's. Whether this is so or not, it must be admitted that coal consumption is of less account than speed, although the difference in consumption will hardly compensate, in the case of the two boats, for the small amount of difference in speed.

There was less vibration in the French boat, which may account for her being beaten, for rigidity of structure invariably affects the speed unfavourably. In May, 1884, Messrs. Yarrow & Co. built for the British Government two boats of 113 ft. length and 12½ beam, which were to maintain a speed of 18 knots fully equipped. They were to be provided, forward, with two torpedo guns, and also with a revolving torpedo gun aft. It was intended that they should be lifted on board of large ships and thus carried where wanted, which is, doubtless, a much safer plan and much quicker than letting them find their own way, however able they have proved themselves to do this, either under steam or sail.

Some of the boats which Yarrow built for the Austrian Government, during recent trials at Pola, attained a speed of 20 knots an hour with all coals, torpedoes, and crew on board; these vessels did this after being three years old, but great credit is due to the Austrian Government for keeping up a well-trained staff of officers and engineers for this service. It very often happens that this important duty is not attended to, that the boat is laid up, amongst others, till a day or two previous to the trial, when, as may readily be understood, the trial trip speed is seldom or never obtained. It shows the necessity of having well-trained engineers and crews who must have their boats in nearly constant exercise, and learn to comprehend many things about her which they can only obtain by daily practice. The idea of quarterly trials by our Government is to be deprecated as next to useless; they should be weekly, at least.

It may perhaps astonish our countrymen, and, indeed, all other people, that Great Britain up to May, 1884, had so few vessels of a sea-going type. At that date the Russians came first on the list with 115; the French, 50; Dutch, 22; British, 19; Italian, 18; Austrian, 17. The British had 3,740 miles of coast line to guard, and the Russians not more than 2,070. This is a very serious state of things, and one which casts very grave reflection upon the energies of various British Governments. The great dangers attending torpedo boats are from the boilers being penetrated or the engines damaged by shot, and various suggestions have been made for other means of propulsion. About a year ago Mr. Barnaby, jun., read a paper at the Institute of Civil Engineers, touching the application of turbine propulsion, which has been suggested and greatly favoured by many naval authorities. Some very exhaustive experiments with the turbine were at that time carried out by Messrs. Thornicroft, and were fully described in Mr. Barnaby's paper. Previous to this, in the year 1883, the E. P. S. Co., in company with Messrs. Siemens and Yarrow, built and tried experiments with an electrical launch, with a view to replacing steam as a propelling power. This boat was 40 ft. long by 6 ft. beam, and, without difficulty, obtained a speed of eight statute miles an hour.

The electricity was stored in a number of accumulators, which were placed in the boat's bottom below the water line, and in this position pretty well protected against gun fire. The accumulators were charged by mechanical means, and when once charged the launch was available for use at a moment's notice. There were, however, such difficulties and objections to the charging method as to seriously depreciate the boat's otherwise great value, as she was absolutely noiseless in her approach, and would have neither funnel, fire, nor smoke to betray her whereabouts to an enemy. Such a launch would be, in many respects, superior to steam in such features as embody a night attack, or stealthy movements of any kind. In May, 1884, at a lecture given by Mr. A. F. Yarrow at the Royal United Service Institution, a model of this electrical engine was exhibited; but although the torpedo boat constructors which he represented were eager to employ such simple machinery in the propulsion of torpedo boats, they have not yet seen their way sufficiently clear to employ it in the place of steam, with that degree of certainty and freedom of "hitches" or "breakdowns," which are to be so carefully guarded against in torpedo warfare. The subject, however, of electrical and hydraulic propulsion is being vigorously investigated and experimented on by the chief builders and engineers of torpedo boats.

Messrs. W. H. Allen & Co., York-street Works, Lambeth, have secured an order to supply six sets of pumping engines for the North German Lloyd new steamers being built by Messrs. John Elder & Co., of Glasgow. Each of these enormous engines are capable of developing from 7,000 to 8,000 H.P., and are on the triple compound principle, with 150 lb. steam pressure on the square inch. The centrifugal pumping engines are to be capable of discharging 10,000 gallons per minute, and are fitted with compound engines having cranes at right angles. Each boat will contain a pair of pumps and a pair of compound engines, the pumps themselves being capable of lifting direct from the bilge to a maximum height of 25 ft. These boats will be some of the largest and most important that have been built with so high a steam pressure as 150 lb. The combined power of each set of pumping engines will be 250 H.P. for one ship.

The Admiralty authorities intend to deepen that part of Dover Bay which extends about 70 yards eastward of the Admiralty Pier.

THE MANCHESTER SHIP CANAL.

After an immense amount of opposition and a prodigious expense, the promoters of the Manchester Ship Canal are much to be congratulated for having had their great scheme sanctioned by Mr. Forster's committee. This tribunal approved of the Preamble of the Canal Bill as the House of Lords' Committee have previously done, and therefore there will not likely to be any important opposition to the passage of the measure through both Houses of Parliament.

While the opposition of the Liverpool people to the projected waterway has been very keen, nearly every inhabitant of Manchester has been a warm partisan in its favour, and when it was announced that the Select Committee of the House of Commons had approved of the Preamble of the Bill, numerous flags were hoisted in Manchester, Warrington, and other adjacent places for the success of the measure, and the rejoicing of the people was exceedingly great. At a crowded meeting of subscribers to the scheme at the Manchester Town Hall, on the 18th ultimo, at which Mr. Daniel Adamson, chairman of the promoters, presided, much enthusiasm was manifested. The number of applications for shares was very great, and one person requested 1,000 to be allotted to him. We agree, therefore, with Mr. Adamson, that the promoters of this waterway are now in a way for fair plain sailing.

The Bill of last year, though passed by the Lords, was rejected by the Commons owing to the weight of testimony brought to prove that dangers to the docks and navigation of Liverpool would result from the cutting of a canal direct through the middle of the estuary, as the training walls would interfere with the scouring action of the tide in the estuary, and cause a silting up of the sand-banks behind the proposed training walls, and which banks are at present washed out by the tide. It was stated that if the promotors of the canal produced a scheme in the following session which would have its course round the margin of the estuary on the Cheshire side instead of the centre of the waterway, the Liverpool people would raise no objection to the project.

The promoters altered thir scheme accordingly and presented a third Bill this year. The opponents, however, raised objections to the new plan, which imply that the dangers threatened last year had not been got rid of. It is contended that the total capacity of the estuary will actually be diminished, that its land waters will be interfered with, and that a permanent channel will be formed along the Cheshire shore which will have the same damaging effect upon the remainder of the estuary, which it was thought that the training walls of last year's plan would have. On both sides of the question very distinguished witnesses have been examined. The objections of the opposing railway companies have almost from the first been overruled, but the Liverpool navigation interests have undergone, as they really deserved, much critical investigation, owing to the very difficult problems to be solved. On this question the interests of Liverpool and Manchester are identical, as, if the port of the former city is destroyed by the growth of the Mersey bar and the silting up of the docks, the Manchester Ship Canal would be useless for the transit of ships. The description given of the Canal from Manchester to Runcorn, in our article last year, is fully applicable to the plans which were used for the Bill during the Parliamentary Session just closed, but the docks at Manchester have been entirely re-modelled, and the character of the estuary works wholly changed in their plans.

Instead of one large dock on the site of the racecourse, there are to be three docks, to be called the Manchester and Salford docks. They will have a greater length of quay space than the dock first designed. The entry to the docks from the canal will be by large ship-locks below Trafford Bridge. Vessels will at once pass into the Salford dock, which will be constructed on the land between the racecourse and Trafford Road. Ships will enter the middle dock from the Salford dock by a cut crossed by a swing-bridge, which will be opened by hydraulic power in about a minute. From the middle dock they will pass the River Irwell, which will be greatly widened on the Manchester side, into the the Manchester dock, which will be made by a series of wide jetties and basins in the side of the Pomona Gardens and the adjoining land. Large steamers can be unloaded at the quays of these docks. The entrance locks will keep up 26 ft. of water, and ships can be raised to the existing level of the river above Throstle Nest weir, which will be close to the future level of the water in the docks. Barges can also pass under Trafford Bridge into the Manchester docks; and large ships to Woden Street

foot-bridge, as the river will be widened and deepened to that point. It will also be dredged from thence to Hunt's Bank, as deep as the bridges and adjoining property will permit, to enable large barges to lighter goods to or from the shippingto any wharf or warehouse on the river. This will be of very great advantage in expediting and cheapening the carriage of goods.

With regard to the great changes in the estuary works in the new plans the first of them is that instead of training walls in the middle of the estuary, the Canal which was formerly designed to end at Runcorn, will be continued to Eastham, partly along the Cheshire shore and partly through the adjacent territory. After going through the outer basins of the Mersey and Irwell Navigation Company above Runcorn, the Canal will be continued along the Runcorn shore, and so widened as to form a dock and wharves for Runcorn, passing under the bridge of that town, and closely co-extensive with the exterior walls of the Runcorn and Weston Point docks, over the mouth of the River Weaver into the Frodsham marshes. After passing through these marshes, and almost parallel with the river, it will skirt the shore near Ince, and pass inland across Stanlow Point and in front of Ellesmere Port; afterwards inland again until it approaches Eastham Ferry, when it enters the river in deep water. A uniform level of a neap tide from Eastham to Latchford, a distance of 20 miles, will be maintained by these tidal locks at low water.

The water will be retained in the Canal where it runs along the shore by embankments on either side, which will be faced with stone. The waterway will also be faced with stone when it is inland. To protect the Canal from storms, and facilitate its navigation permanently, the embankment will be constructed several feet above high water at springtide. At certain points two long weirs will be formed in the embankment to permit the tide rising or falling in the Canal at a similar rate as in the estuary, as well as to allow the water of the Weaver or other rivers flowing, as now, into the estuary. These weirs, which will be at a level, will fully provide for the passage of floods. The small quantity of water which will be used at low tides at Eastham for locking purposes, will be tidal stored in the Canal. The lock gates will be open except at low tide, and vessels will pass in and out of the canal without locking. The channel below Eastham locks is to be dredged into the deep water of the Sloyne. To enable ships to pass in and out of the estuary, lock gates are to be provided through the embankment opposite the present docks at Runcorn, Westen Point and Ellesmere Port. The Canal will be very advantageous to sea-going ships, which can now only reach the Upper Mersey ports at high water of spring tides, as these vessels will be able to reach their ports without waiting in the Lower Mersey, which they are now compelled to do at neap tides. The length of the Canal will be 35 miles, and, when necessary, will be lighted and buoyed so that ships can pass at any hour.

The objections to the Canal on commercial grounds have been very great, but have been fully answered by the promoters and their witnesses. One of the leading objections to the waterway is, that it would fail to pay a dividend on account of the keen competition of the railways. Now, if the railway companies trading between Manchester and Liverpool, fail to reduce their rates down to the level of the maximum rate of the Manchester Ship Canal, they will have no appreciable amount of goods traffic between these cities. Now, is it quite evident that these land carriers will not reduce their traffic-charges lower—as it has been alleged they might do—than those proposed for the canal, and fixed in the schedule of this Bill for the waterway. The reason is because they have already reached that irreducible minimum cost of carriage, which leaves them with little or no profit for dividends; and which will operate equally, if not more powerfully, in the case of the Canal, in preventing the railway companies charging less than the Ship Canal maximum rates. Several cases may be mentioned in which water are much much lower than railway rates. From South Wales to Birkenhead coals are carried more than 150 miles by railway at less than a half-penny per ton per mile, to compete on fair terms with sea-freights from Cardiff. This is scarcely remunerative. In the conveyance of coal from the Tyne collieries to London, the railway rate is far in excess of the sea rate, for while the latter is 4s. to 4s. 6d. per ton, the former is 10s. The railway charge is, however, subject to city dues to the extent of 1s. 1d. per ton, leaving only 8s. 11. a ton for railway carriage and wagon hire for a distance of more than 250 miles.

The cost of yarn from Manchester to Glasgow is 16s. 9d. by canal and water, and 25s. by railway. In his recent evidence before the House of Lords' Committee on the Manchester Ship Canal Bill, Mr. Findlay, the general manager of the London and North Western Railway, said that of the salt shipped which was brought from the Weaver district and taken on board at Garston or Liverpool, only 14,000 tons came by railway, while 900,000 or 1,000,000 came by water. He also stated that "all the inducements they can offer to the trade would not succeed in diverting any considerable quantity to that trade from the Weaver to the railway." These facts are very strong in favour of the transit of goods being cheaper by inland navigation than by railways. Notwithstanding the much cheaper carriage of salt on the Weaver the trustees who manage the navigation of this river hand over a handsome surplus annually to relieve the rates of the county of Chester. At one time a large overland trade by railway was done in salt from the district of Winsford, in that county, to Newcastle and other towns on the east coast for export and manufactures, but in consequence of the high rates of conveyance of this commodity by railway in excess of those by water, but an infinitesimal proportion is now sent overland. The following table gives the charges from Winsford to the places mentioned below, viz.:—

Rates of carriage on salt from Winsford to	By water.		By rail.	
	s.	d.	s.	d.
London	6	0	13	8
Cardiff	3	6	10	0
Glasgow	4	0	12	6
Aberdeen	8	0	20	0
Newcastle-on-Tyne	4	6	9	0
Grimsby	5	0	8	4

The Aire and Calder Navigation, which runs from Goole to several towns in the West Riding of Yorkshire, carries goods to Grimsby and Hull and Goole at the same sea freight from various continental and otherports. After the goods are placed in the barges of the Navigation Company, at Goole, they are conveyed to the interior at rates at 5d. to 1s. 8d. a ton less than the rates charged by the railways. This is a very rich and prosperous canal company, and has such a traffic that the railway companies are both capable and desirous of competing for.

In the comparative tables of rates adduced by the promoters of the Manchester Ship Canal to the Parliamentary Committees they show that to compete with the rates in this waterway the railway companies will have to forego their goods traffic between Manchester and Liverpool, and to obtain their working costs from the balance left, which is scarcely sufficient to pay the costs of terminals alone, and in some cases not even that. The effect of the canal rates on the receipts of the London and North Western Railway Company will probably be immense, as that company derives nearly one-half their revenue of £10,000,000 from Lancashire and Yorkshire. It is stated, that, even if the railway companies attempted so reckless a policy as competition at lower rates than the Ship Canal may think fit to charge, the reductions would extend to all places in the neighbourhood, other than those served immediately by the waterway, but to which the Ship Canal Company would be legally entitled as a forwarding company to claim through rates by the Railway and Canal Traffic Act of 1873. Nor does it appear that the railway companies could legally apply any part of their capital, even if available, for revenue purposes, to supply any deficiencies of dividends arising from a foolish competition with water carriers. From what has been stated, and upon a consideration of the overwhelming amount of evidence that exists against any effective competition by the railways against the Ship Canal, we cannot expect to be troubled by any further lengthy arguments on this part of the subject.

Another leading objection which the opponents of the waterway have adduced to the undertaking, is the allegation that any savings to merchants which could be made by the canal would be absorbed by the freight likely to be charged for sending ships up to Manchester, beyond that paid by shipment to Liverpool. It is generally the custom for ships bound from America and elsewhere on an open charter-party to call at Queenstown or Falmouth for orders, and afterwards to a port in the United Kingdom, or on the Continent between and including Havre and Hamburg. Under such a document a ship would have to go to Manchester for the same freight as to Liverpool. The following table indicates the tendency for equal freight charges in the same locality:—

EQUAL SEA FREIGHTS TO VARIOUS PORTS, IRRESPECTIVE OF TIME OR DISTANCE.

COAL.	DIFFERENCE.
1. Cardiff to Antwerp .... Do. Cronstadt	Four days longer: viz., three days to Antwerp and seven days up the Baltic to Cronstadt.

2. Cardiff to Malta .... Do. Constantinople ... Do. Odessa	Six days longer to Constantinople and eight days longer to Odessa than to Malta.
3. Cardiff to Gibraltar .... Do. Malta	Four days longer to Malta.
IRON AND COAL.	
4. Newport (S. Wales) to Liverpool .... Cardiff to Liverpool	Fifteen miles further from Newport.
COTTON.	
5. Galveston to Liverpool ... New Orleans to Liverpool	One day longer from Galveston
GRAIN AND COTTON.	
6. Bombay to Marseilles ...... Do. London .... Do. Hull	Ten days longer to London than Marseilles
GENERAL CARGO.	
7. London to Bombay .... Do. Calcutta	Ten to twelve days longer to Calcutta than Bombay; frequently at the Calcutta rate, though the longer distance is less.
8. London to Cape Town ... Do. Port Elizabeth	Forty hours longer to Port Elizabeth.
9. London to Hong Kong ... Do. Yokohama...... Do. Hiogo............	Steamers are ten days longer reaching Japan after they arrive at Hong Kong.
10. Liverpool or London to Genoa and Trieste	Ten to eleven days longer to Trieste.
11. Norway, Antwerp, or Hamburg to Grimsby............ Norway or Antwerp to Hull Do. do. Goole	Thirty miles further up the River Humber to Hull. Fifty do. do. to Goole. (Vessels have often to wait a day for the tide to get up to and down from Goole.)
12. London to Penang .... Do. Singapore	One day longer to Singapore.
13. London to Batavia .... Do. Sourdbaya	Three days longer to Sourdbaya
14. London to Hong Kong ... Do. Shanghai	Four days longer to Shanghai.
PROVISIONS.	
15. New York to Cardiff ...... Do. Bristol	Twelve hours longer up a tortuous river (the Avon) to Bristol
16. New York to Southampton Do. London	Twenty hours longer to London.
17. New York to Glasgow...... Do. Cardiff ...... Do. Hull .... Do. Newcastle ...	In some cases a day and a half to two days longer.
SUGAR.	
18. Havana to Glasgow .... Do. Greenock	Twenty miles further up the river Clyde to Glasgow.

From Liverpool to Columbo by the ships of the Clan line, the freight is 35s., while from Liverpool to Calcutta it is only 17s. 6d., although 700 miles further. Several shipowners from London, Glasgow, and other ports have stated in evidence that they would send their ships to Manchester for similar freights as to Liverpool.

Much time has been occupied by the promoters of the Canal in proving, which they have adequately done, that a sufficient traffic will come on the waterway to cause it to be a good remunerative investment as we shall show. The estimated cost of the Canal works, according to the Engineers' report, amounts to £7,292,972, of which £1,700,000 is for the purchase of the Bridgewater navigation which now has a gross income of £309,364, and a net profit of £61,110 per annum. This waterway is capable of great development as a feeder and distributer for the Ship Canal. The income named is no estimate of its commercial value, as the Mersey and Irwell navigation, which forms part of the purchase, is disused, therefore the revenue is chiefly earned by the old Bridge water Canal, the value of which is about £1,000,000. When converted into a Ship Canal the Mersey and Irwell navigation will become developed. It is thought that the least quantity of traffic on the Ship Canal will be 3,000,000, which would, at an average of 5s. a ton, produce a gross income of £750,000 per annum. The working expenses are estimated at £112,500, being a higher rate per mile than the Suez and Amsterdam Canals. The net revenue would thus be £637,500, which exceeds $6\frac{1}{4}$ per cent. on the £10,000,000 capital of the Company, consisting of £2,000,000 and £8,000,000 of shares. From three to four millions of the capital of the undertaking can partly be raised by loans and partly by rent charge, or guaranteed preference stocks at not more than from 4 to $4\frac{1}{2}$ per cent. All the river revenue will, therefore, be left availablle for dividend on the ordinary share capital, which in that event may be estimated at from $7\frac{1}{2}$ to 8 per cent.

The rate of 5s. per ton for carriage of goods on the Canal is far below the present average charges on 3,000,000, and neither includes dues on ships nor profits on labourage and warehouses, which forms half the income of several dock companies. According to Sir William Forwood there were 25,000,000 tons of traffic in and out of Liverpool per annum. Now, not only will a large portion of the trade be carried on the Manchester Ship Canal, but we are convinced that this waterway will abstract much trade from London, Goole, Hull, and other ports. The opening of the Panama Canal, and the probable construction, ere long, of the ship railway between the Atlantic and the Pacific, will greatly add to the traffic of the Canal. Its revenue will also be greatly increased by the new commercial industries which will be established in its neighbourhood, and the coastwise trade the waterway will develop.

The Canal will be within six miles of the Wigan coalfield and about thirty-five to forty miles from the great Midland coalfield, which is sixty or seventy miles from Liverpool, while that city is twenty-five to thirty miles from the Lancashire, and 150 miles from the South Wales coalfield. The Yorkshire coalfield will also, as we pointed out last year, naturally add to the benefit of the Canal, as much fuel is likely to be carried on it, both for home consumption and export. The 3,000,000 tons which is supposed to be the minimum quantity of traffic carried on the Canal, is, we believe, too small an estimate for the Manchester centre, for we are told that the small port of Garston has a traffic of 2,000,000 tons, the docks at Weston Point about the same, the Bridgewater Navigation 3,000,000 tons, and Ellesmere Port 400,000 tons. The estimated traffic in the Ship Canal, as given in evidence by the promoters, is as under:—

	Traffic. Tons.	Revenue.
Imports (foreign)................	2,672,250	£643,860
Exports (foreign)	3,378,600	405,145
Coastwise traffic	3,000,000	375,000
Barge traffic to and from Liverpool	500,000	62,500
Local traffic in the Canal........	100,000	5,000
	9,650,850	£1,491,505

As there is a further item of ship dues held in reserve of £187,500, the grand total revenue of the Canal is calculated to be £1,679,005. "These estimates," says a writer in the *Manchester City News*, "were furnished in great detail, and Mr. Marshall Stevens, of Liverpool, was cross-examined at great length, to try and weaken them, but without any material effect. In fact, if the railway companies were made a present of all the items they cavilled at with any degree of success, such items would not represent more than ten per cent. of the whole estimate. The railway companies, it is true, have tried to attenuate the promoters' traffic estimate by alleging that the entire traffic carried into and out of Liverpool in 1884 was not more than 9,864,652 tons. They also said the whole traffic carried to and from Manchester and twelve miles around, was only about $2\frac{1}{2}$ million tons. These returns have undergone much criticism, as, whilst they are not open to the charge of being absolutely inaccurate, they are misleading. . . . . Not more than half the stations shown in Airey's Railway Maps as embraced within that area, were included. It left out traffic such as that between Widnes and Liverpool, and other river ports; and it leaves it to be inferred that the Bridgewater traffic is only 850,000 tons, whereas the Navigation Company's chairman says their traffic is about 3,000,000 tons. But if these returns are true in their entirety, they are at best fallacious. It is absurd to draw an iron ring around Manchester and say that from within that area, and that only, shall you derive any part of your trade. The same cause that operates in the case of Liverpool to enable it to draw traffic from Birmingham and Stoke in the Midlands, Bradford, Leeds, or Sheffield in the West Riding; or Preston, Accrington, Whitehaven, or Glasgow in the North, will operate equally powerfully in the case of Manchester. The cotton market, for example, will inevitably be drawn to Manchester. The trade of towns like Halifax, situated at only half the distance to Manchester that they are to Liverpool, and whose manufacturers largely use Manchester as their market already, will have many reasons for adopting it as their port, the best of all being the saving in carriage which a shorter distance and the power of

obtaining through rates by the Canal will secure to them. The bringing of a port inland, practically thirty miles nearer to all the centres of consumption and production is a distinct gain of facilities to all the manufacturing centres within 100 miles of Manchester, and this accommodation is bound to be followed by the trade. The mere fact that Liverpool is approached by a salt-water highway, and Manchester is not, gives it no advantage whatever from the point of view of the importer or exporter, if he can get the ship up to Manchester at the same freight as to Liverpool."

About 70 per cent. of the income of the Ship Canal will be derived from toll for traversing it from its entrance at Eastham to the Manchester docks, while the remaining 30 per cent. will be obtainable from wharfage. Little or no revenue is derived from the Grimsby, Fleetwood, and other docks owned by railway companies, as to increase the traffic to these ports and consequently to their lines, they charge merely nominal rates.

To those who have little faith in the commercial prosperity of the Ship Canal on the ground that many small inland canals pay but insignificant dividends, it should be answered that these are to a great extent owned by railway companies, who often diminish their traffic by excessive tolls, tariffs, and other means. Their insufficient breadth and depth frequently prevent their interchanging traffic with other canals, and also injures their local carrying capacity. Their expenses however are not proportionately lessened, therefore they cannot be compared with any ship canal either for income or working expenses.

Considering the high estimate given of the great future of the Manchester Ship Canal, and the readiness with which the preliminary expenses were provided, and the numerous applications there are for shares, this great water way, which is the most magnificent engineering undertaking in Lancashire during the last half century, bids fair to become one of the best works for the profitable investment of capital, and for this purpose it has not only been highly recommended to the moneyed, but to the working classes. The great additional mercantile marine traffic which will pass over the Mersey bar after the construction of the Canal materially adds to the necessity, already very great, of affording sufficient protection to the port of Liverpool against the attack of a naval enemy. This subject is one which is now engaging much attention both by the Admiralty and the public generally. The very vulnerable condition of the port and shipping at Liverpool and the city itself, and how they should be protected, have been very prominently notified in a recent article in the *Army and Navy Gazette*, and it is to be hoped there will be no delay in rendering the port of Liverpool, which is the principal one in the world for the import of provisions, as secure against hostile attacks as the increasing offensive powers of foreign navies necessitate.

TRADE NOTES FROM THE TYNE, WEAR, HARTLEPOOL AND THE TEES.

The Tyne.—Although there are several idle yards on the Tyne, the river is, on the whole, better supplied with work than any other ship building centre of the same area in the Kingdom. Between Elswick and Shields there are some 30 vessels in course of construction, the aggregate tonnage amounting probably to 40,000 or 45,000 tons. Messrs. Leslie's establishment, Hebburn, is the busiest on the river, there being seven large steamers on the stocks, and others to follow. The firm are also extensively repairing a war vessel belonging to the Chilian Government, in their graving dock. Messrs. Armstrong, Mitchell & Co., have just secured for their Elswick yard an order from the Admiralty for two gunboats. This work, along with the ironclad which the firm have just commenced, and a couple of vessels of the cruiser type for other governments, will keep the yard pretty busy for some time. The firm have new premises nearly completed in which they contemplate manufacturing the engines and boilers required for the vessels built by them, which work has hitherto been mainly done by Messrs. R. & W. Hawthorn, of St. Peters. At the Company's Low Walker Yard there are but three vessels in progress, one of which is almost ready for launching. Strictly speaking, therefore, there are only two vessels building, and this means a very small amount of work for a yard in which as many as ten vessels can be laid down at one time. Messrs. Palmer are busy with the two Cruisers ordered by the Home Government, and the framing is now well advanced. There are a couple of merchant ships on the stocks, but some berths are empty, and prospects in this department do not seem good. The Tyne Ship Building Company have two small vessels on the stocks, and another of the largest class is to be laid down. Messrs. Readhead, who were quite busy during the winter and spring, but have lately had very little work, have again secured some orders, and the keel for a large vessel is now laid in the yard. There are two other firms on the river that have a fair amount of work in land, namely, Messrs. Richardson and Messrs. Swan & Hunter; but the remaining ones which have not temporarily closed their gates, are only keeping open on a very limited amount of business.

In Marine Engineering, the only establishments that have any work worth speaking of, are Messrs. Palmer, Jarrow; Messrs. R. & W. Hawthorn, St. Peter's; and the Shipway Engine Works, Wallsend. The locomotive engine shops are all slack, with the exception of the North Eastern shops at Gateshead, where work is usually maintained at a uniform rate of steadiness. The smalle. engine works are generally having very little to do, but Messrs. Carrick & Wardale, of the Redheugh Works, owing to their high reputation for steam pumps, &c., are getting a pretty fair run of work.

The Wear.—The Wear shipbuilders who, at the invitation of the Admiralty tendered for the four gunboats recently given out, have failed to secure a share of the contract, but one or two merchant orders have cropped into their hands, and these will, to some extent, compensate for the disappointment. The Sunderland Shipbuilding Company have obtained an order for two small steamers, and as they have some other new work in hand, besides a very important repairing contract, their establishment is now pretty busy. Messrs. Pickersgill, who at present have only one boat on the stocks, have just secured the order for a steamer of large size, and the North of England Shipbuilding Company, whose yard is empty, have got a big sailing ship to build. Messrs. Short Brothers are on with their last ordered vessel, but for the sake of keeping their best hands in employment, are about to lay down a vessel on their own account. Messrs. Doxford have only one vessel in course of construction, but as it is the largest ever built on the Wear, being over 400 ft. in length, and about 50 ft. beam, the work in connection with it is keeping a large force of men engaged. At the Deptford yard (Mr. James Laing's) there were two vessels launched during the month, and there are two others nearly ready for putting off. There is only one other vessel in progress, and very little prospect of any further work. Messrs. J. L. Thompson and Sons, of the North Sands yard, have held the premier position during the whole year, so far as regards the possession of work. They have launched four vessels since May, and have now six on the stocks, and others to lay down. All the vessels referred to are of large tonnage, and great as is the trade depression, speaking generally, this establishment was never busier than at the present moment. The firm have shown much enterprise in adopting improved methods of working. Tweddell's hydraulic rivetters have been in use for a couple of years, enabling the firm to do the framing work of vessels with a rapidity unattainable before, and at about half the ordinary cost. They have lately applied the hydraulic power to other purposes, for which steam winches had hitherto been used, and they are about to introduce further changes of an interesting character in their working arrangements. Messrs. Austin, a few weeks ago, tried the experiment of carrying on work in the iron department on the "time" instead of the "piece" system. Although the platers have not taken kindly to the change, and have tried not a little to obstruct the progress of the work, the result is sufficiently satisfactory to induce the firm to adhere to time work during, at all events, the continuance of the present dullness. Taking a general view of the situation, it may be said that the state of work on the Wear, is slightly better than it was at the end of last month, but there is very little chance of further improvement this year, and the prospect for the winter, is still depressing.

Hartlepool and the Tees.—Shipbuilding at the Hartlepools is fairly prosperous, considering the state of the industry in other districts. Messrs. Withey have a couple of steamers in progress, and Mr. W. Gray has a good deal of work in hand. A rare feat in shipbuilding was accomplished by this eminent builder a short time since. A vessel of 1,700 tons was completed in six weeks from the laying of the keel to the launching, and in two weeks more was made ready for sea. Such rapidity of execution as this must be regarded as the result of energetic management, combined with the possession of first-class facilities for carrying on work. One of the yards at Stockton is pretty busy, but the other two are slack, and at the Middlesbro' yards, there has been very little doing for a long time. It is stated, however, that Messrs. Railton, Dixon & Co., have now got an order for a large steamer, the construction of which will be proceeded with at once.

Messrs. Richardson, marine engineers, Hartlepool, are pretty well off for work, having several triple expansion engines in hand for vessels building on the Wear. Messrs. Blair, of Stockton, are also having a fair supply of work, and bridge building at Middlesbro' is pretty brisk. The Eston Steel Works ceased operations on the 15th instant, owing, it is understood, to the absence of specifications, and it is not known when work will be resumed. Most of the forges and iron works in the Tees district are standing, and foundries are generally speaking showing a a near approach to the same unenviable state of matters.

TRIAL TRIP OF THE MONA'S QUEEN.

On Tuesday afternoon, July 7th, a trial trip was made from Fleetwood to Douglas, of the latest addition to the fleet of the Isle of Man Steamship Company, the *Mona's Queen*, which is to supersede the *King Orry* on the Fleetwood-Douglas station. A large number of people assembled on board the vessel at Fleetwood, most of them having been brought from various parts of Lancashire and Yorkshire by the Lancashire and Yorkshire Railway. About eighty or ninety in all gathered on board, amongst the company being Mr. William Dalrymple and Captain Philip Gill, directors of the Isle of Man Steam Packet Company; Mr. T. P. Ellison, secretary; Mr. Joseph Orford, of the firm of Messrs. Thomas Orford & Sons, the Liverpool agents; Mr. William John, general manager of the Barrow Shipbuilding Company; Mr. George Rogers, chief engineer; Mr. J. S. Clarke, manager of the building yard; Mr. Dobie Little, manager of the Cumberland Union Bank at Barrow; Captain Humphries, Mr. David Caird, shipbuilder, Barrow; Mr. J. Copeland, engineer, Barrow; Captain Stokes, Barrow; Mr. John Tattersall, Grange; Mr. D. Davidson, Mr. James Cruikshank, Mr. John Maddock, superintendent of the Lancashire and Yorkshire Railway, Manchester; Mr. John Mark Quayle, the Rev. Mr. Quick, Mr. George Scott, Mr. John H. Townley, &c. Invitations to be present were accepted by Lieutenant-Governor Walpole and the Bishop of Sodor and Man, but they were unable to carry out their intention, and Mr. H. B. Noble (the chairman of the Isle of Man Steam Packet Company) was unavoidably absent. The *Mona's Queen* left Barrow at six o'clock on Tuesday morning for Fleetwood, and on her arrival was joined by a company who had left Douglas that morning by the *King Orry*. At twenty-five minutes to three o'clock the vessel steamed out of Fleetwood, Captain John Hill being in command, and in spite of a strong head-wind, bore away for Douglas; but after some distance had been traversed it was found that the engines were "priming," in consequence of foul water taken in at Fleetwood, and upon this a return was made to the outermost buoy off the port. Some delay ensued, and it was not until nearly four o'clock in the afternoon that a proper start was made. The run certainly tried to the fullest extent the sea-going properties of the ship, but considering the heavy weather it could hardly be considered a fair trial trip, Douglas not being reached until nearly half-past seven. This was not the official trial for speed, however, for that took place on July 4th, from Barrow to the St. Bees, where the vessel made a mean speed of 19 knots, the maximum being 19½ knots.

The *Mona's Queen* is built of Siemens-Martin mild steel. Her dimensions are 320 ft. by 38 ft., by 14 ft. 6 in. depth of hold, with a gross tonnage of about 1,458 tons, and she has been provided with accommodation for carrying about 1,500 passengers. Her fitting and appointments are of the most elaborate and elegant description, and will probably not be surpassed by any vessel afloat. Her saloons are very commodious, her upper saloon measuring 75 ft. in length, by 34½ ft. in breadth. This is panelled very handsomely in satinwood and walnut, decorated with gold, the entrance to it being 13 ft. by 14 ft. This saloon, together with the captain's room and stateroom, are upholstered in peacock-blue velvet. The design of the ladies' saloon, which measures 17½ ft. by 36 ft., is carried out in very fine sycamore and walnut, with gold moulding and capitals, and is upholstered in bronze-green velvet. The lower saloon, which is 82 ft. in length by 35 ft. in breadth, is upholstered in crimson velvet. The sofas in this saloon, ladies' room, and stateroom are twenty, arranged so as to be easily converted into sleeping accommodation. The smokeroom, 24 ft. by 34½ ft., is panelled in ash with oak framing and teakwood moulding, and upholstered in buffalo hide. The refreshment bar in this apartment is very elegantly fitted-up with marble-top counter, and tables and other fittings in polished hardwood. The second-class saloon and ladies' saloon are upholstered in carriage rep. The whole of this upholstery, which is very luxriantly and elegantly done, has been carried out by Messrs. Townson & Ward, of Barrow, who upholstered the *Peveril*, another vessel built at Barrow for the Isle of Man Company. Whilst every attention has thus been given for the accommodation and comfort of the passengers, the officers and crew have not been overlooked, their quarters being very comfortably fitted and provided with every convenience. Instead of the usual deckhouse, as in the other steamers belonging to the company, she has been fitted with a poop extending to the bridge, well lighted by unusually large sidelights, The promenade deck, an advantage always appreciated by passengers, extends from side to side, and practically the whole length of the ship. The vessel is steered by Messrs. Muir & Caldwell's steam steering geer amidships, and Hastie & Co.'s screw gear aft. The anchors are worked by Messrs. Matthew Paul & Co.'s steam windlass; and she has also a steam capstan fitted aft for warping purposes, supplied by the same makers. The boats are four in number; and for the additional safety of passengers she is provided with eight of Williams's patent double life-raft seats on deck. The vessel is propelled by four cylinder compound oscillating surface-condensing engines of about 5,000 indicated H.P. The diameter of the high-pressure cylinder is 50 in., and that of the low-pressure cylinders 88 in., the length of the stroke in each case being 72 in. The frames and other important parts are made of steel, for the purpose of securing lightness and great strength. The paddle wheels are on the feathering principle, and are fitted with carved steel floaters. The circulating water for the surface condensers is supplied by two powerful centrifugal pumps of the Barrow Shipbuilding Company's usual pattern, and powerful double donkey pumps and fire engines are fitted in the engine-rooms for the purpose of feeding the boilers, pumping out the holds, washing decks, and extinguishing fire in case of need. For this latter purpose a complete system of pipes is laid the whole length of the ship, so that water can be supplied to any part. Steam is generated by four boilers, constructed wholly of Siemens-Martin mild steel, each having six furnaces. They work at a pressure of 85 lbs. Powerful fans driven by independent engines are fitted in the stoke-holes, with forced draught, under which circumstances the power, and consequently the speed, will be greatly increased. The speed expected from the vessel is about 20 knots, and she will be the fastest of the Isle of Man Steam Packet Company's already fine fleet. The ship and engines have been designed by the Barrow Shipbuilding Company. The hull has been constructed under the superintendence of Mr. George Hughes, and the engines under the superintendence of Mr. Lewin the company's engineer.

Luncheon was served up on board, after which Mr. John, who presided, proposed the "Health of the Queen," which was received with great enthusiasm. Mr. John next proposed the toast of "Success to the *Mona's Queen*." This was coupled with the name of the Isle of Man Steam Packet Company. In proposing this toast Mr. John said:—You are now on board the fastest paddle steamer of the fleet, and probably the fastest steamer afloat. No contract I have ever been interested in has given me greater pleasure both in undertaking and successfully carrying the vessel on to completion. From the time of entering into the contract our relations with the owners have been mosamiable; and I am sure the *Mona's Queen* will more than fulfil all the expectations that have been formed of her, as the draught of water is under the limit, the speed good, also the time of construction. This is the very day of the contract time in which the *Mona's Queen* was to be delivered; and in proposing the toast of the *Mona's Queen* I have great pleasure in coupling with it the name of Mr. Dalrymple, chairman of the board of directors.

Mr. Dalrymple, in response, said:—I have to thank you sincerely for the kind way in which you have spoken of me. I need hardly tell you that this is scarcely a day on which to enjoy yourselves on the water, especially the visitors, and I feel confident that that is not the fault of the vessel but of the weather. I feel sure that every point of the contract has been met, and although we have not yet got the speed we desired, I feel we shall do so, for I believe that the power is there, and that she will prove to have a speed of more than 19 knots. If the Fleetwood station does not prosper it will not be the fault of the Isle of Man Steam Packet Company, who are here giving a proof of their wish for their prosperity. If the directors of the railway company will give us a good port at Fleetwood, and I see their dredgers are still at work (which shows that they are in earnest in their endeavours), and if they will only bring the people to Fleetwood

I am sure that the Isle of Man Steam Packet Company will bring them over in hundreds of thousands to the Isle of Man (hear, hear). This is the fourth steamer we have had from the Barrow Shipbuilding Company, and I have no doubt that we shall yet have a faster boat than the *Mona's Queen*, and that Mr. John will yet make greater improvements in all directions. He may perhaps some day be able to do away with those ponderous boilers and work the engines with electricity instead of steam. Men who can turn out work like this—and on the very day on which they said they would do it—are fit to do anything. In conclusion he proposed the health of Mr. John, the builder of the boat, with whom he coupled the name of Mr. Clarke, the shipbuilding superintendent.

Mr. John, in responding, said:—The Isle of Man Steam Packet Company carries hundreds of thousands of passengers, and their vessels are far ahead of those of any other company in point of excellence. If Mr. Dalrymple had asked me three years ago to construct a vessel to steam 18 knots a hour I should have thought that such a thing was impossible. In those three years, however, great improvements have been effected in all branches of shipbuilding, and it is quite possible that in a year or two further improvements will be made in advance of those introduced into the *Mona's Queen*. I have to thank you very sincerely for the kind manner in which you received the toast.

SHIP-BUILDING IN THE UNITED STATES.

THE recent failure of John Roach, and the controversy about the *Dolphin* which he has built for the United States Navy, has directed much attention to shipbuilding by our Transatlantic brethren. A Member of the iron shipbuilding firm of Cramp and Sons, of Philadelphia, has made some important observations respecting the cause of the depression of this industry in the States. At an interview with a reporter of the *New York Evening Post* he said that he does not think that iron shipbuilding is in a worse condition than other manufacturing interests, and that its depressed state is owing to the fact that capitalists have been induced to invest their money in railroads rather than into ship construction. On being asked if his firm would take a contract for building a ship for the Government, after the opinion of the Attorney-General in the *Dolphin* case, he answered that they would, without hesitation; but they would only guarantee their own work; therefore they would not consent to construct ships on plans and specifications and models furnished by the Navy Department, and guarantee a certain result. But particular results they would guarantee if left to build from their own plans. Nor would they make any guarantee under any stipulations of divided responsibility. What is more interesting to shipbuilders of this country is the further statement by this American gentleman, that not only his own firm, but probably any of the large shipbuilding concerns on the Delaware River, would undertake to build iron ships, quality for quality, for a smaller sum than that they would cost in England or elsewhere. Many grains of allowance must be made for his concluding remarks, unsupported by evidence, that the leading liners running between the United States and Europe are not equal to those which could be had in America for the same money. We wonder what the Royal Commission just appointed for investigating the causes of and the remedies for the depression of trade, will think of such a bait as this to abstract much valuable industry from our shores.

THE PROVISIONING OF OCEAN STEAMERS.

FEW persons are aware of the extensive nature of victualling on board the great ocean steamers. Each vessel is provisioned as follows for the passengers and crew:—3,500 lbs. of butter, 3,000 hams, 1,600lbs. of biscuits, exclusive of those supplied for the crew; 8,000 lbs. of grapes, almonds, figs, and other dessert fruits; 1,500 lbs. of jams and jellies; tinned meats, 6,000 lbs.; dried beans, 3,000 lbs.; rice, 3,000 lbs.; onions, 5,000 lbs.; potatoes, 40 tons; flour, 300 barrels; and eggs, 1,200 dozen. Fresh vegetables, dead meat, and live bullocks, sheep, pigs, geese, turkeys, ducks, fowls, fish, and casual game are generally supplied at each port, so that it is difficult to estimate them. Probably two dozen bullocks and 60 sheep would be a fair average for the whole voyage, and the rest may be inferred in proportion. During the summer months, when travelling is heavy, twenty-five fowls are often used in soup for a single dinner.

TORPEDO BOATS.

THE Admiralty, having taken into consideration the special character both of the hull and machinery of first and second class torpedo boats, have issued a series of regulations for their more effectual preservation.

After reminding officers in charge of the craft that they are built of very thin steel—only $\frac{1}{16}$ in. thick—and that the utmost care is required in their management, their lordships ordered that no portion of the hull should on any account be devoid of paint or other anti-corrosive composition in good condition. The bottoms of all torpedo boats in the reserve which are not in use are to be coated with red lead only, and not with experimental composition. Whenever practicable the boats are to be hauled up or docked for examination every two months, and the interval between such examinations is never to exceed four months. In order to reduce the amount of corrosion to a minimum, should any of the inside of the vessel be bare of paint or composition, pieces of zinc are to be placed on the inside of the vessel, as low down as possible, so as to be emerged in bilge water should there be any. The zinc should be in metallic contact with the frames of the vessel, or other parts of the structure if preferred, and the arrangements should be made under the advice of the Admiralty chemist. Before any torpedo boat is laid up or placed in store the engines are to undergo a thorough examination, and any defects that may be discovered are to be reported, and, if possible, made good at once. If this is not practicable the defects are to be made good as soon as possible after the boat is stored. If the boat has been attached to a ship, before being returned to store, the chief engineer of the ship is to make good the defects as far as possible. The engines are to be thoroughly disconnected; the whole of the working parts are to be cleaned and oiled and re-adjusted. The internal parts are to be drained out, and all the doors and covers are to be so left that periodical examinations may be made of the interiors. The after part of the propeller shaft is to be withdrawn, so that it may be cleaned and oiled, and the stern tube is to be drained out and painted, or otherwise put into a state of preservation before the shaft is replaced. The engines are to be turned several times every week, the boiler is to be thoroughly washed out with fresh water, and the chief engineer is to superintend the examination and see that the fire-box and tube-plate are properly gauged, to ascertain if they have received any injury during the time the boat has been under steam. The safety valve and all other boiler mountings are also to be examined, but the safety valve spring is not to be screwed down. After being washed out the boiler is to be gently warmed to a temperature well above that of the atmosphere and then closed and kept so. If unslaked lime can be readily obtained, a small quantity in suitable pans is to be laid on the top of the tubes before closing up the boiler, but the boiler is not to be kept open more than a day or two for this purpose. The bilges are to be cleaned and the bunkers cleared of coal, and the interior of the boat is to be examined throughout, the lining of the bunkers being removed for that purpose if necessary. Any damage to the paint work is to be at once repaired, and the boat is to be put in every respect in as good a condition, both as regards her machinery and her cleanliness, as when she was issued from store.

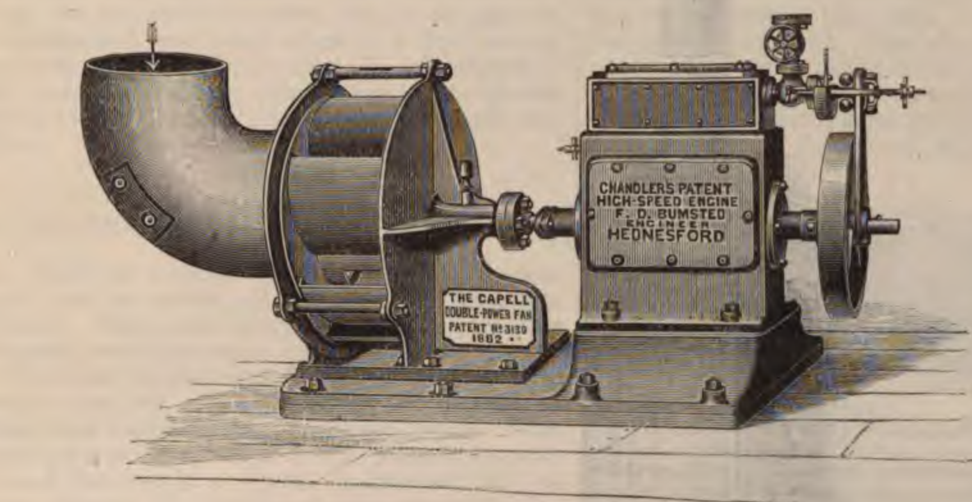
The Admiralty have authorised some important experiments to be conducted at Portsmouth with the object of determining the value of liquid fuel for the use of ships of war. There are various systems before the world, but the particular system which is to be tried is that of Baron Adelsward, which has been largely introduced into the French Navy. The coal oil is placed in a tank, where it is raised to a high temperature by steam from the boiler. It is then allowed to pass to the furnace doors, where it comes into contact with a jet of steam and is driven into the furnace, which has been previously heated in the usual way. The inventor claims that his system is suitable for the propulsion of armour-clads, but the experiments at Portsmouth will be confined to No. 22 torpedo boat, one of the boats of the largest type, which have lately been received from Messrs. Thornycroft. Should the trials prove successful, there can be little question of the superiority of the liquid fuel over coal for consumption in these small craft, quite apart from the question of economy. In the first place there will be no stoking required, thus enabling the complement on board to be reduced, and in the next place there will be no necessity for the use of forced draught and the arrangement of fans by which it is produced. These are important advantages when the confined space below deck in the torpedo boats is considered.

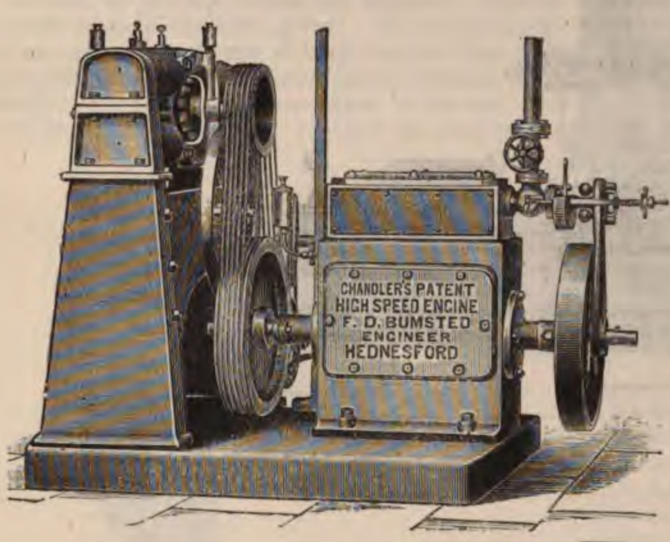
International Inventions Exhibition.

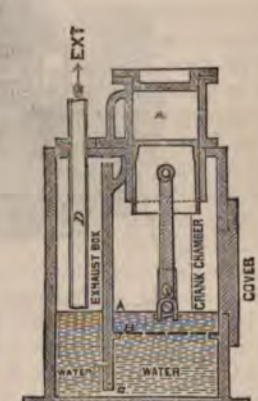
CHANDLER'S HIGH SPEED ENGINE.

WITH the demand for high speed engines that has followed from the introduction of the electric light and the greater use of centrifugal pumps and fans, we find amongst the competitors for favour Messrs. Chandler, of the Cannock Foundry, Hednesford. Their engine is a very neat type, and consists in its ordinary form of two single acting cylinders with the cranks opposite each other. From the first fact it will be understood that all the parts are continually in compression, and there is no back lash or play even when the brasses are nearly worn through. Two heavy fly wheels are attached, one at each end of the engine. The admission and exhaust of the steam is regulated to each cylinder by means of valves operated from eccentrics on the main shaft. A feature, and one that is peculiar to high speed engines of this class, is that it is fitted with expansion valves. These are worked from separate eccentrics, and the rods pass through the main valves. They permit of being altered to cut off at any point, and by their adoption at least 25 per cent. of the steam formerly used is said to be saved. As they are also placed near the ends of the cylinders, the ports are very short. Steam enters at the top of the casing which surrounds the parts, the chest being above the cylinders; it then finds its way by means of the valves to give the down stroke to the pistons, and afterwards passes through an aperture into the exhaust box.

A claim is made in this engine for a perfect system of lubrication with the least expenditure of oil. The

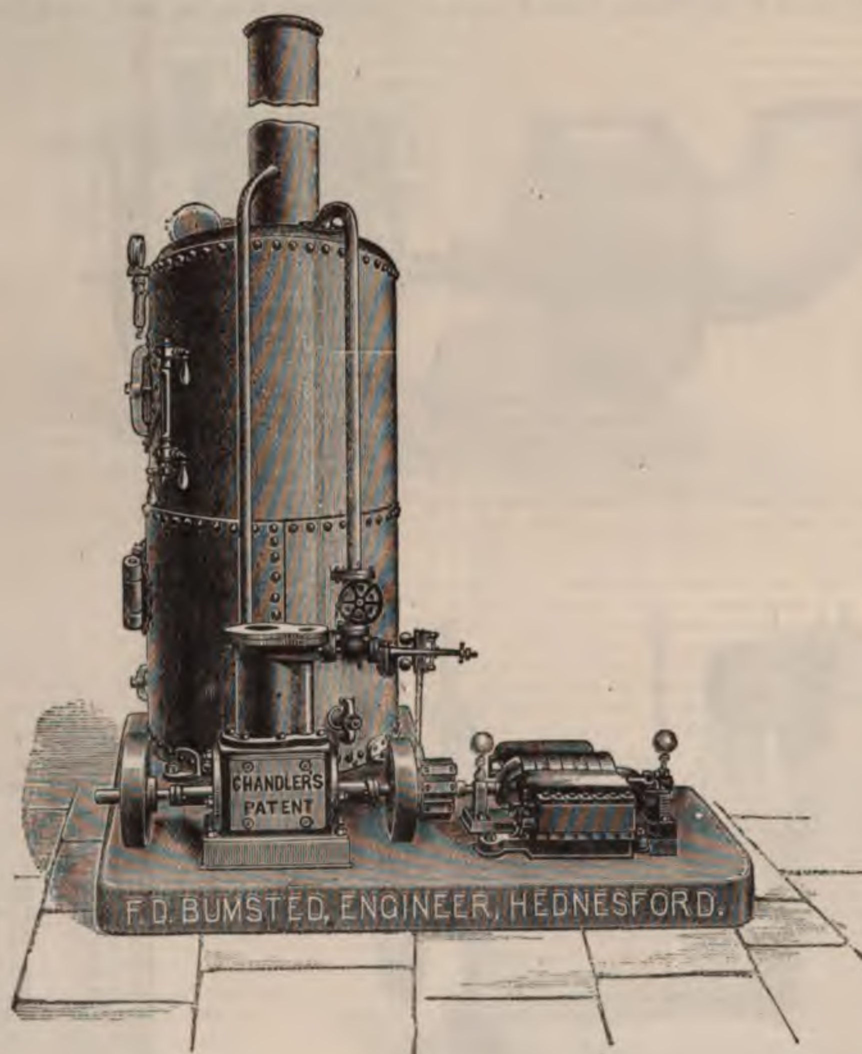






crank shaft of the engine at the lowest point in its revolution constantly touches the surface of an oil bath in the closed motion chamber, and the oil is thus dashed over the whole of the bearing surfaces. The oil is maintained at a constant level, so that it is utilised to the last drop by an ingenious arrangement. The motion chamber is in connection with an exhaust box in which water collects from the exhaust steam, and the supply of oil floats on the top of this water cushion in the motion chamber. The water and oil is maintained at constant level by an overflow from the exhaust box

into a bend in the exhaust pipe, by which any surplus accumulation of water is carried off. Thus, as the supply of oil decreases by use, an access of water from the exhaust floats up the oil to the original level, and thus causes the whole of the oil to be utilized. Similarly, when a fresh supply of oil is introduced, part of the water is discharged into the exhaust, and the level of the oil bath remains at its proper height. Careful experiments are said to have proved the loss of half a pint only in a 5 in. single engine driving a Siemens' 2,000 candle power dynamo at 950 revolutions and for about 15 hours. It is undoubtedly an advantage for an engine of this type to retain a supply of lubricant for a period of from two to three days, and without any waste. The pistons and cylinders are thus thoroughly and automatically lubricated, and it is possible in an engine of this class when running one way to take off the door without any scattering. The casing is of course in sections, so as to render the castings simple and cheap. The governor is of the ball type, as shown in the illustration, and works an equilibrium valve. The pistons and rods are very light and strong, being manufactured of forged steel and phosphor-bronze. This last detail is one requiring attention where the speed is up to 1,200 revolutions a minute.



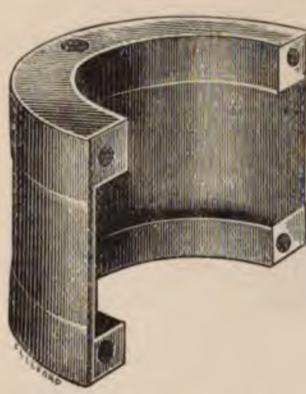
At the Exhibition the engine is on a base plate, as shown, and drives a No. 2 Phœnix Dynamo at 1,500 revolutions, this being a speed 2 to 1 compared to the engines. At the back of, and bolted on the base plate, is a standard five feet high, upon which is a "tension wheel" for tightening the driving rope. This can be easily effected while working, and is partly an idea of the late Professor Fleeming Jenkin. Silence is a feature of the engine, and one may easily pass by without noticing any sound whatever. The same remark, however, applies more or less to other engines of this class, which are enclosed. Another engine is coupled direct to a Siemens' dynamo in the electric lighting shed for supplying current to secondary batteries. This we illustrate with boiler, as also one driving a Capell fan for supplying forced draught in ships. It only remains to mention that

there is an arrangement for lubricating automatically the governor spindles; and it is claimed that this endeavour to attain a perfect system in this respect has most to do with the success of the engine.

Generally speaking engineers will understand that high speed engines have attained their popularity by reason of economy as well as efficiency. There are fewer parts than with larger classes; this means less friction and liability to derangement. With such conditions a high speed is easily obtainable, there being theoretically no limit to the rapidity of the action of steam. It is known, also, that high speed in itself conduces to a saving. On the whole, therefore, for the purposes we have enumerated, and many others of a light nature, there would seem to be a future for this introduction of recent years, and we may even expect to see greater novelties in this direction than have already come into existence.

AUTOMATIC METALLIC SPRING PACKING.

An ingenious metallic packing has recently been brought into the market, and is shown at the Inventions Exhibition. There, as at many other stands where there is no motion, very little notice would perhaps be taken of it. This remark applies even to the profession, for with so much to see, and only a limited time at disposal, an engineer must necessarily pass by some good things. That this packing is an improvement on other forms where metal is adopted there can be no doubt. A drawback that has hitherto attended all packings of this description has been a want of pliability when the necessary pressure to prevent leakage has been given. It is hard to persuade an engineer in charge of large engines that with metal bearing on his rods that scoring will not take place eventually. He knows that this cannot be the case with a gasket of soft material; but whatever the composition

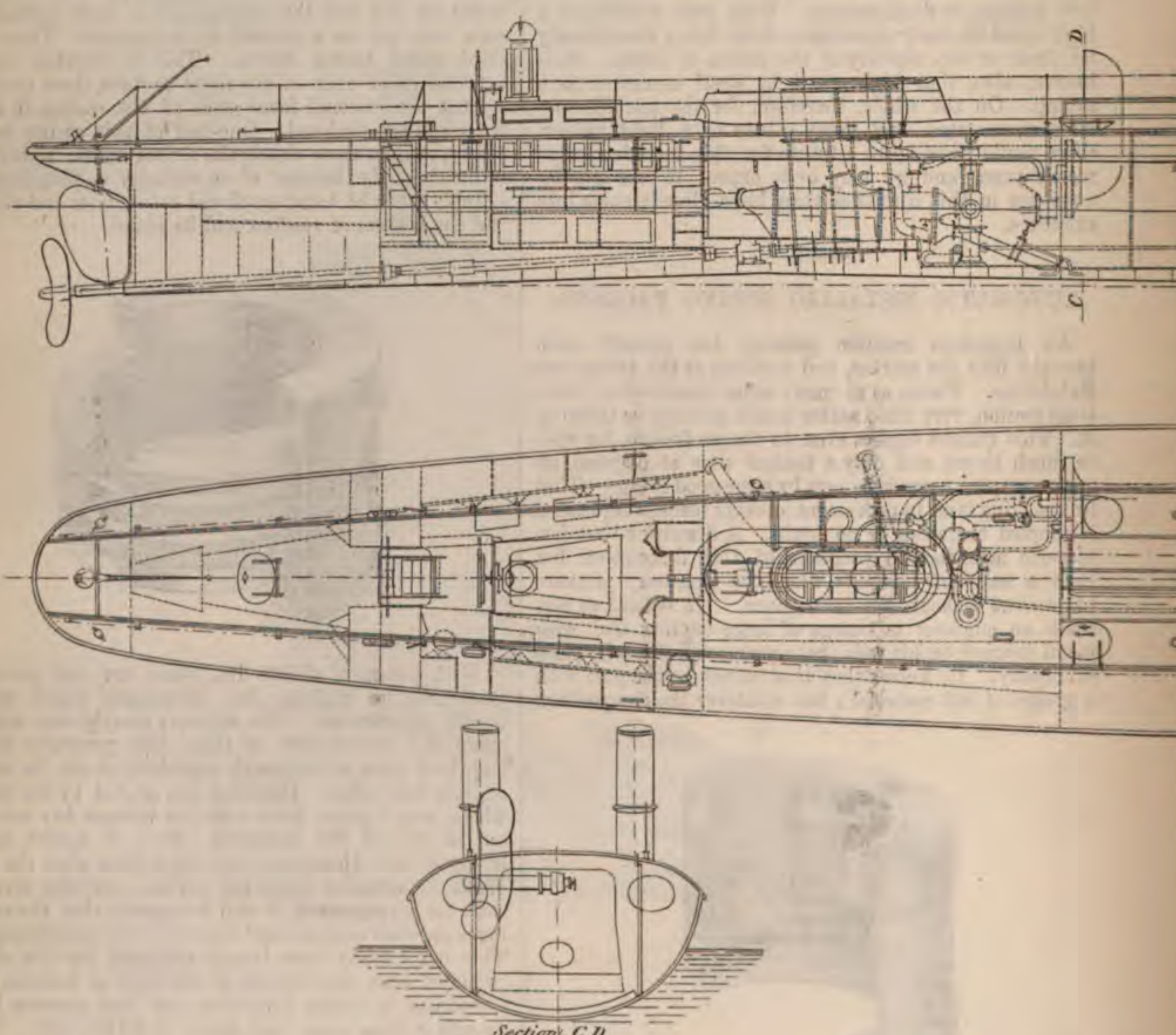


of the other there is an uncertainty attending it which precludes a trial. Moreover, most metallic packings with which we have been previously acquainted possess a certain amount of wedging action which is not favourable to them.

Messrs. Marshall & Thunder, the patentees of this system, need, as far as we are aware, no special metal whatever, as the packing gives to the motion of the rod, be the vibration what it may. This important feature is obtained, as will be seen from the engravings, from there being two rings independent of each other. Both have spiral springs, which surround them and keep them to their work, while lateral play can take place in one ring at a time. Each ring is divided into two or more pieces, the joints being made steamtight by the insertion of wedge-shaped tongue pieces on the end surfaces. The grooves are dovetailed to retain the tongues, and the effect is that when the block springs press the rings inwards on the rod the tongues are in turn pressed the same way, and so a perfect fit is ensured. There is a third spiral spring shown. This is inserted on the bevelled inner ends of the rings to force them outwards against the internal faced ends of the casing, in which the rings are enclosed. One-half of this casing is seen empty, to show more clearly the arrangement. This casing is fitted in the interior of an ordinary stuffing-box, any suitable material being employed between its end surfaces and the bottom of the box and its gland.

With pressures of 160 lbs., which are now general, a good metallic packing has advantages which will be readily appreciated. The ordinary descriptions will not stand the intense heat of these high pressures for any length of time, consequently repacking at sea for marine engines is avoided. Instances are quoted by the makers where long voyages have been run without any attention on the part of the engineers. This, of course, follows from the self-adjustment that takes place after the wear. When we mention again the perfect elasticity given by such an arrangement, it will be agreed that the advantages are such as to warrant a success with marine engines, This has already been largely obtained, for five of the principal lines running out of the port of London have introduced it, mostly with their new high pressure boats, though in some cases with those of 90 lbs. only. These lines comprise the P. and O., the British India, and the Union Co.

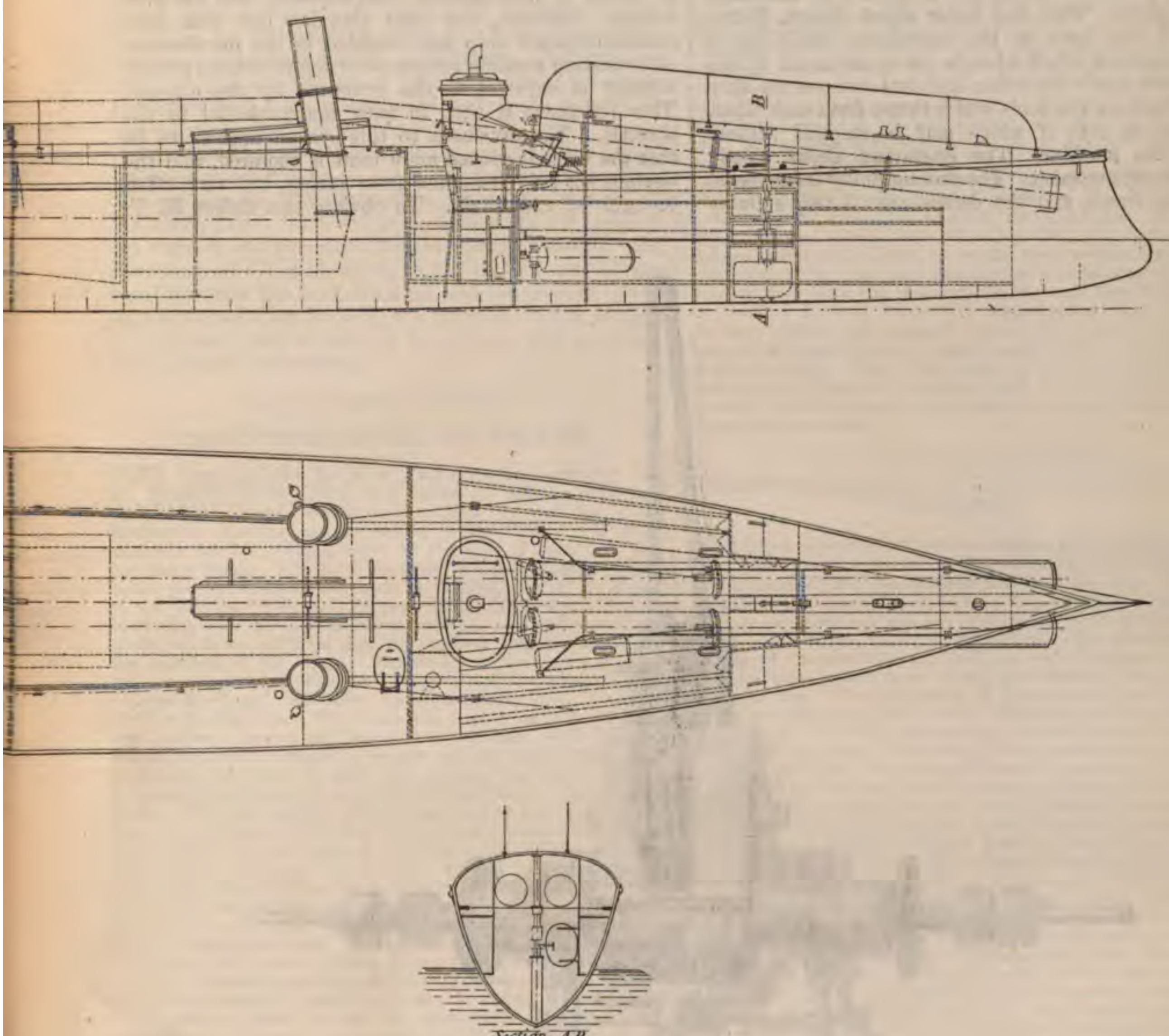
The makers have obtained the highest award for packing at the Inventions Exhibition, where may be seen also a patented plan for doing away with two stuffing-boxes between the cylinders of a tandem engine. In the centre of the column is a recess which is filled with the firm's packing, and this gives one stuffing-box instead of the usual two. The cylinders may thus be brought closer together, and space economised. With a packing of the kind we have described, where no attention is required during a voyage, such an arrangement is obviously possible. It is thus fitted, we understand, in the s.s. *Rome* of the P. and O. Co.



THE "

The first sea-going

For description see art. " I



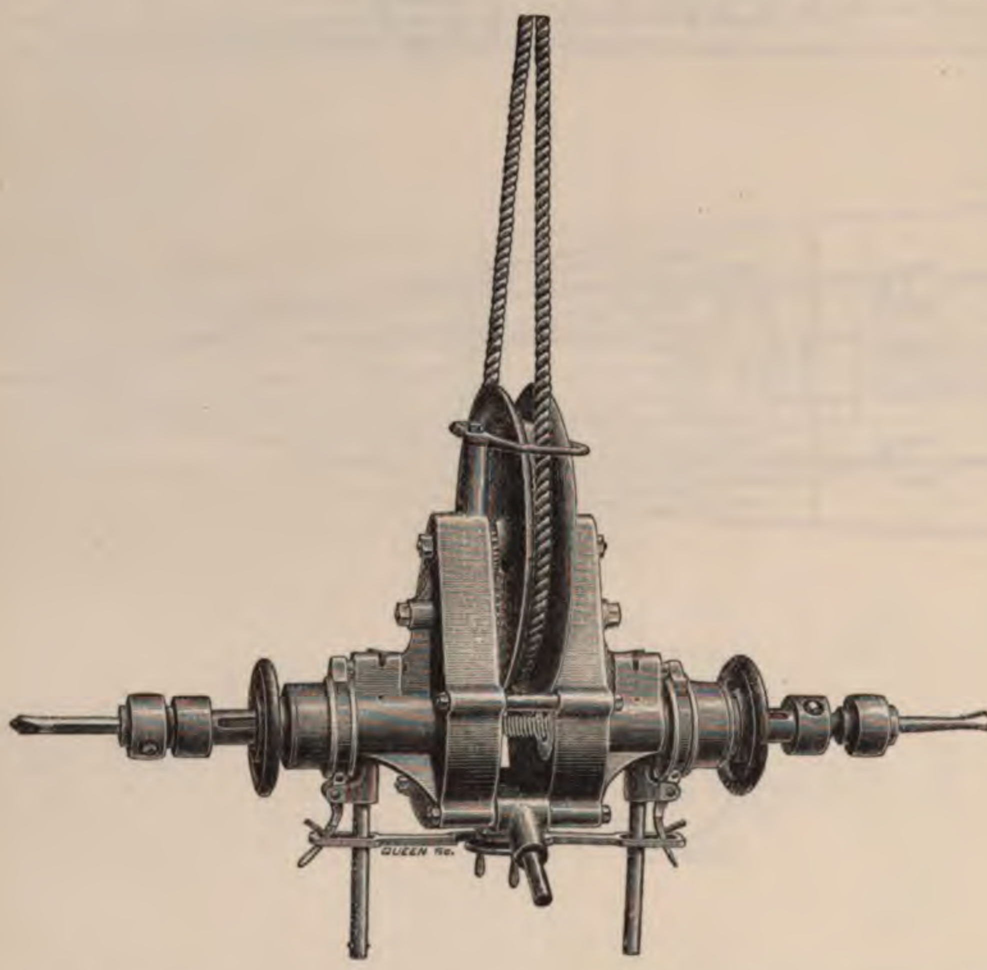
O U M."

Boat ever built.

pedo Boats," page 143.

PORTABLE BOILER-DRILLING MACHINE.

SINCE the introduction of mild steel in the manufacture of boiler plates, and the desirability for drilling the holes in preference to punching them, there has been a demand for machines either to do the work rapidly before the plates are in place, or to do so after the shape has been given. With this latter object Messrs. Sharp, Stewart & Co. have at the Inventions Exhibition a portable machine, which when in use is suspended by the driving cord inside the boiler, and thus occupies no shop space. There are two tools, which thrust from each other, and either or both of which may be stopped without stopping the machine. The engraving shows clearly enough the arrangement. The driving pulley is supported in a strong frame, and the details are all very suitably and neatly worked out. Holes up to $\frac{7}{8}$ in. in diameter may be drilled by the machine, which is specially designed for drilling from the inside of the shells of locomotive and other boilers, up to 2 ft. 6 in. diameter. There are self-acting feeds, and quick spindles are supplied for opening out and making the holes true, which have been previously drilled or punched smaller than the finished size.



MARINE ENGINE GOVERNOR AND SPEED INDICATOR.

THERE is a special novelty shown at South Kensington which will be of some interest to our readers. It is a new form of governor for marine engines, the principle of which is quite distinct from anything that has gone before. Hitherto, the form that has met with most success on board ship has consisted in the introduction of a resisting medium (either air or liquid) when a greater velocity is imparted to the governor by the engines. This resistance is then in turn communicated to the throttle. The drawback to this system appears to be that the valve is opened more than is required, and the engines not only prevented from racing, but very often brought up excessively. To obviate this defect, M. F. Almquist, of the Swedish Navy, has worked, and apparently with success, as far as a cursory inspection permits of forming a judgment. By means of a pump in connection with the engines (a rotary type on the end of the shaft being preferred), a continuous stream of water is kept flowing through two pipes after the cataract form. In the governor is a small box containing a piston, the under side of which is in connection with the

pump. This piston receives motion as the speed of the pump increases, the fluid not finding its way round the pipes as easily as before. Motion is thus given to a slide rod, which admits steam to the governor cylinder, another feature being that this is as quickly cut off by an outside collar operated upon by the main piston itself from above. This following action thereby prevents the main piston being driven to the end of the cylinder, and so depriving the main engines of steam. Extreme sensitiveness is a peculiarity of this arrangement, and the same may be had for any speed that is desired, by simply turning a cock. There are fewer packings than with an ordinary governor, and no belting.

The same cataract principle is applied to a speed indicator which may be placed in any position in the ship. The compression of air formed as before operates on an ordinary gauge. This will not only register the speed of the engines, but also the direction ahead or astern. An advantage will thus be noted, as the captain can always see if his order has been executed, and the progress of the ship noted, whether he be in the cabin or on the bridge. At a future time we hope to be able to give complete drawings and descriptions.

THE KUNSTADTER PROPELLER.

THE report of the Board of Engineers appointed by the Secretary of the Navy last winter to make a thorough trial of the United States steamer Nina to test the J. J. Kunstadter steering and propelling screw, which was submitted to the Navy Department on the 24th of June last, has been made public. The board consisted of Chief Engineer Theo. Zeller, president; Chief Engineers G. W. Magee and G. P. Hunt. It was assisted by P. A. Engineers Stivers, Brown and Nagle. Chief Engineer F. B. Isherwood, retired, also witnessed the trials, and in an unofficial capacity rendered valuable service to the members of the board. The report of the board is quite voluminous, covering 205 pages of manuscript, seven long tables, and two drawings. The entire subject is therein investigated *au fond* for the first time. The vessel was tried from 10 to 45 deg. from starboard to port and from port to starboard. With the two steering systems the following are the turning results obtained at maximum, the vessel in each case making the speed of three geographical miles per hour on the circumference of the turning circle. With the rudder alone in use, and at the angle of 45 deg., the position at which it gives the maximum steering effects, the diameter of the turning circle was 520·543 ft. As the length of the vessel on the water line was 137 feet, the diameter of the circle was 3·8 times the vessel's length. The rudder when used alone was of enormous dimensions proportionately to the size of the vessel, being about 2½ times as large as is habitually given for sea-going vessels. This proportion gives an uncommonly small circle for a vessel to turn by her rudder alone, and is the result of excessive dimensions of the latter relatively to the former. With the Kunstadter apparatus in use, the rudder and the axis of the steering screw being at the same angle of 45 deg., the diameter of the turning circle was 314·181 ft. The length of the vessel on the water-line being 137 ft., the diameter of the circle was only 2·2933 times of the vessel's length. The diameter of the turning circle with the rudder alone was 65⅗ per centum greater than with the Kunstandter apparatus. The time required to make the respective circles was in direct ratio of their diameters. With the proportion of rudder and screw relatively to size of hull, habitually given to sea-going vessels, the Kunstadter apparatus could cause a vessel to make a circle on half the diameter required with the rudder alone, either going ahead or astern. "In naval warfare," the board says, "too high a value cannot be set upon the ability of a vessel to turn on a greatly smaller circle and in much less time than her antagonist." The manœuvring superiority given by the Kunstadter system is so great over the rudder alone, that it would probably decide the victory in a naval engagement in which the vessels were otherwise about equally matched. It would enable a vessel possessing it to ram her enemy or avoid being rammed by him; to select the position relatively to the enemy that was the weakest for him and the strongest for her; and in a fleet fight, would enable the vessels on one side having the Kunstadter system of steering to concentrate in a smaller space and crush an enemy by consequent superior weight of fire. More vessels having the Kunstadter system of steering could be opposed to fewer vessels having the rudder alone, because the former could be manœuvred as safely and as promptly in a very much less space. The board regards no single screw vessel properly equipped for war that has the rudder alone for its manœuvring power when the Kunstadter system is available. The argument in favour of adopting the Kunstadter system for safety, is applicable to all screw steamers, merchant as well as naval. That system would avoid many collisions, besides being of great value as a convenience in the saving of time and trouble in manœuvring vessels in restricted space. The apparatus is considered by the board, mechanically, very simple, and can be easily applied to any screw vessel now in use. It has the least mechanism for the steering effects produced that has ever been proposed; it is but little liable to derangement or accident, and it does not require any special adaptation of engine. A minute examination made by the board of the universal joint and other parts of the Kunstadter apparatus, after long and severe trials to which they had been subject, showed that there had been no sensible wear or deterioration—the tool marks of the pins and bushings still remaining uneffaced. During these trials the vessel was in the same trim and draught of water 9 ft. and 3 in. The experiments were made in the most skilful and complete manner, every quantity involved being ascertained by direct measurement beyond the possibility of sensible error. They were made with both the rudder alone and with the Kunstadter apparatus, and for three different rates of speed. An Isherwood speed indicator, invented expressly for these trials, was used.

BOILER MAKERS AND IRON SHIPBUILDERS' SOCIETY.

THE 51st anniversary of the Boiler Makers and Iron Shipbuilders' Society was celebrated on August 24th at the Crystal Palace by a large number of the members and their families. They left Burdett-road, Limehouse, at 10 a.m., in procession, accompanied by brass bands and banners, and by their new steam launch *Success*, drawn by six horses, mounted by postilions. The procession went by way of Commercial-road, Aldgate, and Fenchurch-street to London-bridge, where most of the processionists took the train for Sydenham. The programme of amusements provided at the Palace comprised the feats of Mdlle. Ella Zuila, the female Blondin wire-walker; the ærial performances of the Hanlon-Voltas, and Dr. Lynn's mysteries. Concert and band music was supplemented by the great organ. At half-past two in the afternoon a meeting was held in the theatre, where addresses on the subject of Trades Unionism were delivered by Mr. Joseph Leicester, corresponding secretary of the Glass Blowers' Association, and Parliamentary candidate for a district in North London; Mr. Robert Knight, the general secretary of the Boiler Makers' Society; Mr. Thomas F. Allen, London District delegate of the society; Mr. Foote, the secularist; and Mr. E. Wood, Mr. Daniel Griffith, chairman of the society, and Mr. J. Clarke, hon. secretary, assisted at these proceedings. The speeches dealt with general principles rather than particular questions, and were designed to have the effect of confirming in the members' minds a sense of the justice of the methods of mutual co-operation and combination which working men adopt in the protection of their own interests. A cold collation was served at the conclusion of the meeting. This society celebrated its jubilee last year; and on that occasion the resolve was taken to recognise each recurring anniversary by an excursion of the members. The society appears to be in a flourishing condition. The sick allowances last year amounted to nearly £19,000, and during the last 18 years to no less than £148,000. "Out-of-work benefit" came to £57,000 last year, and £200,000 in the last 18 years. The following items complete the statistical view of the society's position:—Superannuation last year, £3,886; for 18 years past, £27,216. Benevolent grants last year, £5,000; last 18 years, £28,000. Fares to situations in 18 years, nearly £3,000. Medical attendance last year, £3,898; for the last 18 years, £41,272. Compensation from employers under the Employers' Liability Act last year, £1,245. Bonuses last year, £2,400; in the last 18 years, £14,107. Funerals last year, £3,660; and in the last 18 years, £31,200. Total for benevolent purposes in 18 years, £462,430. The visit of the society to the Crystal Palace was favoured with fine weather, and passed off most satisfactorily.

MERCHANT SHIPS AS WAR AUXILIARIES.

As the purposes and immense utility of merchant steamships to assist our men-of-war do not appear to have been anything like sufficiently notified, we will endeavour, to some important extent, to supplement this deficiency. In attempting to do so we hope to prove that the aggregate usefulness of the mercantile ships we should engage as armed oceanic, distant sea, and home coastwise cruisers, transports, supply, dispatch and convoy ships, colliers, and tugs, may, in the event of war against a first-class naval Power, or against allied second class maritime Powers, be but little, if at all inferior to the ships of the navy for defensive operations at the least.

If hostilities broke out against this country by one or more of these nations, the belligerents would mainly direct their attacks against British commerce on the seas, and our Indian and colonial ports and coaling stations. Such destructive warfare might not only result in a tremendous loss to us, and bring us to terms with the enemy, but would be to it the least risky mode of offence.

Now the importance of such mercantile auxiliaries can best be understood by firstly mentioning the damage which may be done to our property and prestige at home and abroad without them, and then in what manner with their use such a calamity would probably be averted.

There can be no doubt that the leading status and prosperity of this country is mainly due to its possessing by far the greater part of the carrying trade of the world. More than £200,000,000 is invested in this commerce, which gives employment to skilled labour to the extent of £60,000,000 or £70,000,000 yearly; while the value of imports and exports, to and from the United Kingdom, India, and the colonies, is over £1,000,000,000 per annum; and no less than two-thirds of the provisions consumed in this country are imported from beyond the seas. Again, not only have the cargoes in British ships increased at a marvellous ratio during the last fifteen years, but there has been a great accession to our territorial possessions and protectorate abroad.

Though a vast additional amount of work and responsibility has been cast upon our navy, there has been no appreciable increase in its expenditure, until within the last nine months or thereabouts, since 1868; although that of France, Italy, Germany, and Russia has been greatly augmented during the last ten years. In our sea-borne commerce we employ about 21,500 ships, of which about 3,600 are steamers and the remainder sailing vessels. On the other hand, France, which has the most powerful navy in the world after Great Britain, has only about 2,900 merchantmen, of which 700 are steamers. Her commerce, however, is protected at the rate of one man-of-war to nine merchant ships; while our country has only one warship to sixty of her mercantile marine. The French naval cruisers for the protection of her commerce, home coasts, and colonies, are also far more numerous in proportion to the number of cargo-ships than the cruisers of the British navy. The number of such ships built and building for the French navy, of 16 knots speed and upwards, is 9; while those of of our navy, of this and higher speed, is only 17; and about two-thirds of the latter appear to be unready for sea. If, therefore, we were at war with France, unless our commerce was protected by four or five times the number of cruisers which would be directed against it, and unless also this superior number was capable of capturing and destroying the hostile ships; our sailing vessels and all but the quickest of our steamers would be compelled to lie in harbour. The latter would be required for importing provisions for home consumption, and troops, stores, and despatches to squadrons on foreign stations; but it is probable that none could be spared for supplying them, or the coaling stations with fuel.

No first-class naval Power would, however, limit the operations of its cruisers to the specially constructed ships of this class belonging to its navy, but would employ also the fastest steamers of the mercantile marine and other swift merchantmen that could be procured as improvised cruisers. Consequently, if Great Britain had not a sufficient number of men-of-war and merchant ships engaged for cruising purposes, to keep at bay, capture, and destroy these sea-wolves of the enemy; most of our carrying trade would be transferred to a neutral flag, whereby, in addition to other severe losses, our people might be starved into submission to the belligerent's stringent terms in consequence of the possibility of provisions being declared contraband of war. This being so, it is evident that for our own numerous purposes of offensive and defensive warfare with such a Power in the near future, about four-fifths of our cruisers would be necessary to be improvised from the ships of the mercantile marine, as it would be an impossibility to supply them from the navy, and only about half a dozen would at the present time be available for the purpose, and not double the number in a year hence. The speed, armour, and armament of our sloops, gunvessels, and gunboats is well known to be so very defective that they could not be relied upon to render any appreciable service in the capacity of cruisers. For warfare, several of the enemy's cruisers, and especially their fastest armoured and most efficiently armed ships would also commence offensive operations at our very badly protected Indian and Colonial harbours and coaling stations, and especially those of Hong Kong, Singapore, Bombay, Mauritius, the Cape, Ascension, St. Helena, St. George's Sound, Fiji, and Vancouver's Island, which are practically defenceless against long range guns, consequent upon the defective artillery of their forts, the few second and third class warships which assist in the defence of some of those possessions, and the lack of torpedo boats. Now, an attack upon such insecure ports by strongly armed cruisers, assisted by well armed torpedo boats and torpedoes, would result in terrible destruction or loss, including the possible sinking of defective or semi-obsolete ironclads, sloops, gunvessels and gunboats, ships in the harbour, and fuel at the coaling depots, after the enemy had replenished her cruisers' bunkers therefrom, and the bombardment of the towns adjacent to the stations, or the payment of heavy indemnities to escape this injury. The devastation thus wrought would be greatly aggravated by the fact that our naval cruisers, built and building, on account of their lack of sufficient coal-carrying capacity to enable them to steam at full speed for a week, except the *Impérieuse* and *Warspite*; might be rendered useless for offensive or defensive work by not being able to re-coal when required. It must be borne in mind, too, that although the regular naval cruisers of very high speed would, in consequence of being armoured, be much more effective in warfare at close quarters than those of the merchant service, if both classes were provided with the same armament, torpedo boats, and torpedoes, and similarly manned and equally well commanded—the improvised cruisers would be capable of being propelled without re-coaling for more than twice the distance at full, and many of them at a faster, speed than our best naval cruisers. It is questionable, under these circumstances, whether, having regard to the numerous purposes for which mercantile cruisers can be used, these ships may not prove more serviceable to Great Britain in warfare, if properly armed, than the naval cruisers, sloops, gunvessels and gunboats combined, especially if we were to go to war with a first-class maritime Power like France.

Again, as most of our home coast, and river ports and towns are without defence, what is to prevent a destructive raid upon them by some of the more rapid warships of an enemy, accompanied by torpedo boats, as the small number of our ironclads in the Channel and their defective speed could easily be evaded, until a prodigious amount of shipping and other property was destroyed or heavy indemnities levied.

Having pointed out some of the leading dangers which our navy and territorial possessions, commerce, and other property would be subjected to in a war against a powerful enemy or allied belligerents, we will now endeavour to show that by a proper use of well-armed merchant ships, provided with torpedoes and the best means for launching them, such dangers may be averted or greatly minimised.

(To be continued.)

THE BOARD OF TRADE AND THE LOAD LINE.

The following instructions have been issued by the Board of Trade to its surveyors :—" The Board of Trade have received the report of the Load Line Committee, and of the tables and rules annexed thereto. The Board of Trade accept the conclusions of that committee as to load lines as shown in the report and in the tables and rules, and have furnished their officers with copies. Copies can be obtained by the public at large from the agents for the sale of Stationery Office publications, and through any bookseller. The Board of Trade do not propose that their officers shall detain as overloaded any cargo ship on which the load-line is marked so as to give the freeboard assigned to her by those rules and tables, and which is not loaded beyond the limits prescribed therein. As proof that the load line on a ship is marked in ac-

cordance with these rules and tables, the Board's staff at the outports will receive the certificate of Lloyds' Register Committee where a load-line has been assigned by that committee, or the certificate of the Board of Trade where a load line has been assigned by the Board of Trade. In future, the Board of Trade do not intend to assign a load-line for any ship classed in Lloyds' Register Book. In the case of ships not classed, or classed elsewhere, the Board will continue for a time, as heretofore, to assign load-lines on the application of the owner in due course and accompanied by full particulars of the ship. The Board of Trade, in making this announcement, desire to point out, for the information of all persons having the command or management of ships, that those rules and tables give minimum freeboards applicable for ships of the highest class only, and that no ships other than ships of the highest class are to be loaded so deeply as those rules and tables admit. Ships to which a freeboard has been assigned by the Committee of Lloyds' Register, or by the Board of Trade, will, like other ships, be liable to detention if, having regard to the time of the year and the voyage, they are loaded more deeply than the rules and tables admit, and ships to which freeboards are not assigned will receive the particular notice of the staff so far as is possible. Whilst the Board of Trade staff will by this arrangement be greatly relieved of the responsibility for the depth of loading of ships generally, it will be the duty of the Board itself in each case submitted to the Wrecks Courts to instruct their solicitor to raise the question of loading whenever it may appear that deep loading may have contributed to the loss of the ship, and it will also be the duty of the Board of Trade, if in any such case it should hereafter appear that a ship was loaded more deeply than the tables allow, looking to the age, character, class, and employment of the ship, to make the owner and the person responsible for the loading of the ship a party to the case, and to ask for the opinion of the Court on his conduct.—T. H. Farrer, Secretary; Thomas Gray, Assistant Secretary." An explanation of the tables of freeboard for the various types of of steam and sailing vessel is printed with the instructions.

LIQUID FUEL.

WHATEVER shape the fuel question may take, it cannot be otherwise than interesting to marine engineers, and, therefore, we shall make no apology for considering one of its latest phases. It has always been the earnest desire of engineers, ever since steam was used as a means for utilising energy, how to obtain the greatest return out of a given quantity of fuel, and this from considerations of simple economy; but lately we have been warned that if we continue consuming coal at the rate we do, it will not be many years before we have exhausted our coal stores. Whether this danger is real or not—whether the Duke of Argyll is right in his expectation of a not distant day when Britain will have an empty coal cellar—or whether, as others hold, new mines will be found in other districts as may be necessary, the mere notion is sufficient to drive engineers faster along the path of obtaining our power at a less sacrifice.

It has for some time been suggested that a reasonable way to obtain a greater duty from the natural product, and to extend the resources upon which we draw for our power, is to make use of what has been termed "liquid fuel." This is a suggestion which has been put forward very prominently for many years by Admiral Selwyn, and recent practices having occured, showing its advantages under certain circumstances, pressed again with increased eagerness. We have recently been told by this authority, in a paper written by him to the United Service Institution, that, by means of a judicious application of oil, we can expect 1 lb. of it to evaporate 46 lbs. of water, as against 8½ lbs. evaporated by the combustion of 1 lb. of coal; and that the oil necessary can be found in abundance on British and Colonial soil. Gas works, acid works, and other works of a similar description, now throw away as worthless some millions of gallons annually; shale soil, capable of producing an almost inexhaustible supply, exists all over Great Britain; and springs charged with excellent oil are dotted freely everywhere. If these advantages are not exaggerated—if 1 lb. of oil will do the work of 6 lbs of coal, and if it exists in such a plentiful state as to ensure the consequent result of cheapness, and if these advantages can be obtained without any undue sacrifices in other respects, there is no doubt that the extinction of coal fields will a matter too remote for consideration; that our army of miners will have to be transformed into well sinkers and oil distillers, and that our coal miners will be left to be choked with water instead of fire damp.

We must confess that we are not prejudiced in favour of oil burning by the address of its indomitable advocate. Though we are sensible that if even this method of generating steam becomes generally adopted, that it is to Admiral Selwyn that the largest share of gratitude ought to be given; yet we cannot but think that he is rather too enthusiastic to give to plain dry common facts a cold impartial consideration. While we are looking about for reasonings to establish our belief in the asserted remarkable evaporative power of oil, we are a little led away from the point by an enumeration of the consequences that will follow from it. Descriptions of experiments, with the necessary measurements, precautions, failures, confirmations, are left in the shade, beside the figure of six millions sterling saved per year as a consequence of employing liquid fuel; the closer and more cordial relations that are to exist between the mother country and her distant colonies; the safety of the British Empire against her foes; and the prospect of putting a good dinner before each of her worthy sons. We should have been better pleased if he had not left the startling facts to confirm his assertions to the distant future, when the public mind is to be in a more favourable condition to receive them. It is rather a bad sign, too, when an advocate gets angry with those who are compelled to raise reasonable objections; whatever their opposition may be, it ought hardly to lay them open to the charge of limited comprehension, of being not worthy of attention, or of apathy in their country's welfare. But, notwithstanding this sanguineness, there is much truth in many of the Admiral's ideas; we entirely second him in his desire to have the process fully tried, believe in the proverb that he quotes to try all things, and hold fast to that which is good, and are convinced that there are many circumstances where it might be employed with advantage.

Turning now to the immediate question, it may be mentioned that there are several ways of arranging a furnace so that oil may be properly burnt, the object to be accomplished in all is a separation of the particles of oil into a fine spray, in which state it is best adapted for perfect chemical union with the air in which it is suspended. This object may be accomplished by blowing air into the furnace below the oil nozzle; but the most ready and approved plan is to construct a steam jet, running a little into the front of the furnace just below the oil pipe; as the steam is turned on, it carries the oil which it meets into a spray, and at the same time draws air into the furnace. In this way the oil is most effectually burnt, and by adjusting the taps on the oil and steam pipes, the rapidity of combustion can be regulated. The perfection of combustion is also under control; turning the oil tap a little in excess, the air current is not sufficient to supply enough oxygen to completely burn the fuel, and, as a consequence, smoke and hydrocarbons pass off at the funnel unburnt. Closing the tap a little, or increasing the draught of air by opening the steam cock, stops this effectually. Those particular positions of the taps which result just in stopping the escape of unburnt fuel are the most efficient for that particular rate of combustion. Any increase in the opening of the steam tap, though not interfering with complete burning, would result in a loss through introducing a more than necessary supply of air. An ordinary furnace might be fitted as above, but to prevent an irregular and excessive rush of air the furnace should be kept covered with ashes.

From this general description, it will be seen that the character of the combustion is similar to that when coal is burnt; we might, however, expect a certain amount of economy to result from the better mixing of the air and the particles of fuel, but we still should expect a substantial loss, as the products of combustion must pass away at a high temperature as it does in the common coal furnace. In making comparisons, therefore, between coal and oil, we should either take the quantities of water that each pound is capable of evaporating, if all the heat generated by its combustion was employed in generating steam, or the quantities they evaporate in an actual boiler. The value of coal is represented in the paper alluded to as 8½ lbs. of water evaporated per pound of coal, which is its practical performance; but we strongly suspect that the 46 pounds of water evaporated by one pound of oil must be intended to represent its theoretical value, which is obviously unfair. Again, 46 pounds of water is an absurdly high duty for any oil with which we are acquainted. Oils of the description suggested to be employed have certainly a higher proportion of hydrogen in their constitution than has ordinary coal; the usual proportion is 85 per cent. of carbon and 15 per cent. of hydrogen. Knowing, from the experiments of Favre, Silberman, and others, the amount of heat generated per pound

of each of these substances, we can find the total heat-giving capacity for any combination. Without going into the calculation here, we may state that it is such as to produce 19 lbs. of water for each pound of oil. This being the full theoretical value, it should be compared with the full value of the coal, which is 13 lbs. of water per pound of coal; we can, therefore, see that the oil has a greater heat value than the coal, but not nearly to the extent claimed. Admiral Selwyn appears to have an idea that his result cannot be explained by present accepted theories and known facts, and therefore attempts to account for it by a novel explanation, the explanation being, however, but the revival of an old error. It is said that this large amount of duty results from the heat obtained by the combustion of the hydrogen in the steam, the hydrogen having become liberated from its oxygen by some mysterious process going on in the furnace. And we are warned that we cannot raise the objection that the temperature at which hydrogen separates from the steam is equal to the temperature at which it combines with oxygen to reform steam, and so no difference is possible by which water can be evaporated; for the writer undertakes to show that water may be split up into its elements at a temperature far below that which is created when they combine. We do not suppose that the majority of our readers would have raised any such objection, or disputed any such fact; he would not refer to the temperature at all, as it is very little to the point, but he would say that the total amount of heat which is absorbed during the decomposition of water is equal to the total amount of heat developed on the elements recombining, and therefore there is no margin left to do other work. A practical experiment was carried out under Admiral Selwyn's directions at Woolwich, and the results of that experiment were such as to suggest the evaporative value of the oil at the point where we have fixed it. In this experiment, 12·3 lbs. of water were turned into steam for each pound of oil, a result which shows its superiority over coal as regards its evaporative power, but which shows it to be much below that assigned to it in Admiral Selwyn's latest communication on the subject, and indicates that its theoretical value is somewhere not far from 19 lbs. of water.

(To be continued.)

JURY AWARDS AT THE INVENTIONS EXHIBITION.

A supplement to the *London Gazette*, published on August 12th, contains the jury awards made in the Inventions Division of the International Exhibition at South Kensington. There have been distributed 235 gold medals, 438 silver medals, 515 bronze medals, and 24 diplomas of honour. The following are those most interesting to our subscribers who have been awarded gold medals for inventions:—

Barrow Shipbuilding Company. Group of models of ships.
W. F. Batho. Hydraulic dredger.
John Bell & Co. Treatment of asbestos.
Sir H. Bessemer. Bessemer iron and steel.
Bickford, Smith & Co. Safety and instantaneous fuses.
Clark and Standfield. Floating docks, hydraulic grid-dock, and patent slip.
Cunard Steamship Company. Transatlantic steamer *Etruria*.
Denny Bros. Screw steamer *Arawa*.
J. Dillon. Patent hydrographic surveying and sounding apparatus.
David J. Dunlop. Combined steam and pneumatic governor for marine engines.
East Ferry-road Engineering Works Company. Duckhams' hydrostatic suspended weighing machine.
Fielding & Platt. High-speed engine; hydraulic machine for riveting, forging and flanging.
Samson Fox. Corrugated furnace flues for steam boilers.
W. and J. Galloway & Sons. Engines and boilers.
Gardner Gun Company. Machine gun.
Hill & Clarke. Boat-lowering gear.
W. Jessop & Sons. Crucible cast-steel stern frames, solid rubber and cast-steel stern propeller brackets and blades.
David Joy. Valve gear.
Victor Kullberg. Improvement and general excellence in the manufacture of marine chronometer.
Laird Bros. Mail steamer *Ireland*.
A. Légé & Co. Tide-predicting machine, combined recording tide-gauge, anemometer, barometer, &c.
Maxim Gun Company. Novelty and ingenuity of automatic firing arrangement.
Morton & Thompson. Ejector condenser.
Nobel's Explosives Company. Successful application, by Alfred Nobel, of nitro-glycerine to explosive purposes.
T. Nordenfelt. Method of casting wrought iron, and excellence in machine and quick-firing guns.
Phosphor Bronze. Phosphor bronze alloys.
Pulsometer Engineering Company. Pulsometer steam pump, Deane pump, and "Thames" filter.
W. F. Stanley. Improvement in philosophical instruments.
Stothert & Pitt. Wild's patent single chain dredger.
J. & G. Thompson. Transatlantic steamer *America*.
White Star Line. Transatlantic steamer *Britannic*.
Whitehead. Fish torpedo,
Willans & Robinson. Willan's compound engine and electric governor.

The following gold medals have been awarded by the Society of Arts on the recommendation of the Juries. Sir Henry Bessemer, F.R.S., for the invention of Bessemer steel; Percy Gilchrist, for the Thomas-Gilchrist basic process of steel making; Hathorn, Davey & Co., for their domestic motor; Samson Fox, for the invention of corrugated iron flues for steam boilers; Crossley Bros., for the "Otto" gas engine; Ralph Tweddell, for his system of applying hydraulic power to the working of machine tools, and for the riveting and other machines which he has invented in connection with that system; Badische Anilin and Soda Fabrik, for their improvements in the manufacture of colouring matters and intermediate products from coal tar; William Crookes, F.R.S., for his improvements in apparatus for the production of high vacua, and for his invention of the radiometer.

NEW AMERICAN CRUISERS.

PLANS have been prepared for three fast cruisers for the United States navy by Naval Constructor Mintonye, of the Brooklyn Navy Yard, and sent in to the secretary of the Navy at Washington. In designing the vessels, Mr. Mintonye has selected as his models the *Inconstant*, *Mersey*, and *Scout* types of the British Navy. The cruiser designed after the *Inconstant* is to be one of 5,000 tons, with a speed of 18 knots an hour. She is to be 340 ft. long between perpendiculars, and 356 ft. over all. Her breadth will be 48 ft., and her depth from the throat line to the berth deck beam 17 ft. 8 in., and to the top of the main deck beam 25 ft. These dimensions are calculated to give her a mean draught of water of 19 ft. 6 in., and a displacement of 5,000 tons. Her port sill above the mean load-line will be 10 ft. Her engines (of a maximum horse power of 7,700) will be of the horizontal compound type, and work a twin screw. The vessel will be supplied with 14 boilers, each of a diameter of 12 ft., and 10 ft. 6 in. long. The boilers will be divided into two groups by watertight bulkheads, so that if anything happens to one group the other set will remain in working order. Bulkheads will also separate the engine rooms, and the machinery will be protected by a steel deck. The armament of the cruiser will be particularly heavy. She will have a battery of four 8 in. breechloading rifled guns in half turrets, two forward and two aft. Her broadside armament will consist of 12 6-in. rifled guns, six on each side. She will also carry eight Hotchkiss and three Gatling guns, besides a regular torpedo-boat outfit, and search light. The cruiser is to carry 850 tons of coal, which is considered sufficient for five full days' steaming, or 2,310 knots. Her complement of men and officers is to be 418, and she will cost 1,500,000 dollars. The second cruiser designed by Mr. Mintonye will resemble the *Mersey* class. She will differ but little from the one already described, except in her measurements, as she is to be only of 3,700 tons displacement. She will be 325 ft. over all, 46 ft. beam, and 23 ft. 6 in. depth of hold. Her mean draught of water will be 18 ft. Her engines, of 5,500 horse power, will be on the same principle as those of the larger vessel, and her boilers and machinery protected in a similar manner. Her speed is expected to approximate that of the cruiser above described. Her armament is to consist of two 8 in. Barbette guns forward and one gun aft; four 6 in. rifled guns placed in half-turrets, two forward and two aft; six 6 in. rifled guns for broadsides; six Hotchkiss and two Gatling guns. Her torpedo and electric outfits are to be the same as those of her larger consort, and her stores of coal are to carry her the same distance in the same time. The third vessel is to be of 1,600 tons, and identical with the *Scout* class. She will have a length of 225 ft., 35 ft. beam, and 19 ft. depth of hold. The aggregate horse power of her engines is to be 3,500. She is calculated to attain a speed of 16½ knots, and intended to be used more as a torpedo-boat than a cruiser. Her armament is to consist of six 6 in. rifled broadside guns and eight machine guns, besides a torpedo outfit. All the cruisers are to be built of steel.

THE HISTORY OF PADDLE-WHEEL STEAM NAVIGATION.*

(*Continued from page* 131.)

By Mr. Henry Sandham, of London.

The Woolwich Packet Co. and the Waterman's Packet Co. amalgamated in 1865, and worked the general passenger traffic of the Thames below London Bridge. These companies were absorbed into the London General Steamboat Co. founded 1875; which secured for itself a monopoly of the river passenger traffic both above and below London Bridge, in fact from Kew and Richmond up the river down to Southend, Sheerness, and the Nore.

1843.—In this year was turned out on the Thames at Blackwall, by Miller & Ravenhill, the *Prince of Wales* iron steamer, designed by E. Pasco. She was 180 ft. long between perpendiculars, 22 ft. beam, 10 ft. depth of hold, 429 tons old measurement; side-lever engines by Miller, with 46 in. cylinders and 3½ ft. stroke; N.H P. 136, speed 12·75 knots per hour. The steamer *Helen McGregor*, built by Laird Brothers in 1843, should also be noted here on account of her engines of 248 N.H.P. by G. Forrester & Co., of Liverpool, the earliest of which the writer is aware having inverted cylinders. The two cylinders were each 42 in. in diameter with 4½ ft. stroke; the connecting-rod worked between them, from a single cross-head common to the two piston-rods. The vessel had ordinary paddle-wheels 23½ ft. diameter, driven at 23½ revolutions per minute. The steam pressure in the cylinders averaged 3¾ lbs. per square inch. Inverted cylinder engines were the original idea of William Bull, who introduced them in 1790; they are still known as "Bull" engines.

Many instructive examples of marine engines on the direct-acting or Gorgon system were also at work in paddle-steamers between 1843 and 1853, some of which may be mentioned. The engines of the *Centaur*, 565 N.H.P., by Boulton & Watt. A pair of engines of 422 N.H.P., by Scott & Sinclair. Double cross-head engines of the *Nimrod*, 322 N.H.P., by Bury. Double cross-head engines of the *Queen*, 175 N.H.P., by Fawcett & Co. Oscillating engines of H.M.S. *Black Eagle*, 272 N.H.P., by J. Penn & Sons. Engines of the *Thunderbolt*, 326 N.H.P., by Robert Napier & Sons. Single steeple engines of the *Fawn*, 67 N.H.P., by David Napier. Steeple engines of the *Royal Tar*, 161 N.H.P., by Tod & McGregor. Engines of the *Sampson*, 593 N.H.P., by J. & G. Rennie, said to be the first marine engines fitted with the locomotive link motion.

1844.—The following are the names of some well-known short-voyage vessels on the Thames in 1844, both of wood and of iron:—*Father Thames*, *Son of the Thames*, *Royal Adelaide*, *Royal George*, *City of Canterbury*, *Sir Edward Banks*, *William Wilberforce*, *Red Rover*, &c. For sea voyages to and from London in the general coasting service of Great Britain were employed, with many other steam vessels, the *Dundee* and *Perth*, built by J. Wood in 1834, engines by R. Napier, 265 N.H.P., wheels 24 ft. diameter; *London*, built by J. Wood in 1836, engines by R. Napier, 305 N.H.P.; *City of Aberdeen*, *City of Glasgow*, and *City of London*, built and engined by R. Napier in 1844, 405 N.H.P., cylinders 70¾ in. diameter, stroke 6½ ft., wheels 28 ft. diameter; *Duke of Sutherland* and *Earl of Aberdeen*, built and engined by R. Napier in 1847, N.H.P. 375 and 395 respectively, wheels 25 ft. and 25 ft. 10 in. diameter. In this connection should be mentioned a paddle steamer faithful both to her station and to paddle-wheels, the *Baron Osy*, trading from London to Antwerp. The first steamer of this name, 400 tons, was built about 1840. A new *Baron Osy*, 792 tons, 260 N.H.P., built of iron by late John Scott Russell, was placed on this station in 1855. In 1863 she was sunk in the Thames by collision, was raised, and was improved both in hull and in steam power. She then continued her work until 1875, in which year the present *Baron Osy* paddle-steamer was built by Mitchell & Co., Lower Walker, Newcastle; 245 ft. by 30 ft. by 15½ ft., 1100 tons, and 300 N.H.P. Her boilers, machinery, and engines on the oscillating compound system, were furnished by Thompson & Co.

David Napier, of Millwall, turned out two remarkable iron-built vessels, with high-pressure upright or steeple engines driving feathering float wheels of his own design. Particulars of these vessels are difficult to procure. In 1839 he had improved the construction of iron ships by introducing double bottoms; and in 1842 and 1847 he introduced in the upright or steeple engines the use of two or four piston-rods with appropriate connections to drive the main shaft of the engine. The names of his steamers were the *Eclipse* and the *Isle of Thanet*. The *Eclair* and *Rocket* were other celebrated iron-built steamers at this time.

1844.—Hitherto iron had not been adopted for the construction of ships for the Royal Navy. In 1844 two iron-built gunboats of 340 tons burden, 150 N.H.P., are mentioned as completed at Glasgow; and in 1845 two other gunboats with iron hulls were turned out at Blackwall for the Navy. In 1845 the iron yacht *Fairy*, propelled by a screw, was built at Blackwall, by Ditchburn & Mare, for the Queen's use; 312 tons and 128 N.H.P. The *Myrmidon*, of 370 tons and 150 H.P., and the *Bloodhound*, of 378 tons and 150 H.P., by R. Napier & Sons, Glasgow, with the *Birkenhead* frigate of 1400 tons, by John Laird, were also completed.

In the period 1845-1865 the four following companies were working small iron paddle-wheel steamers on the Thames between London Bridge and Westminster Bridge. Some of these vessels attained considerable speed, and are still at work on the same station under the London Steamboat Co.

1.—The Citizen Company. 1846.
2.—The Iron Steamboat Company. 1838.
3.—The London and Westminster Steamboat Company. 1835-6.
4.—The Halfpenny Fare Steamers (Dyers' Hall Co.) 1846.

The first of these small companies ran boats fitted by Messrs. John Penn & Sons with oscillating engines of about 25 N.H.P. Their boats were named *Citizen A*, *B*, *C*, &c., and were also called after the several city guilds: *Haberdashers*, *Fishmongers*, *Loriners*, and so on.

The second ran boats of a rather larger and swifter class, which were built by Ditchburn chiefly, and were also engined by Messrs. Penn & Sons, and were named *Moonlight*, *Starlight*, *Daylight*, and so on; later followed *Matrimony*, *Wedding Ring*, &c.

The third ran vessels from London Bridge to the Surrey side of Westminster Bridge. They are said to have been known as the flower boats, from their names; *Blue Bell*, *London Pride*, *Camelia*, *Dahlia*, &c.

The Citizen and Iron Steamboat vessels ran at fares from two-pence upwards, according to distance. They went up river to Chelsea and to Kew. The London and Westminster boats charged one penny per journey.

The fourth ran vessels from Dyer's Hall Wharf near London Bridge to the Adelphi, Strand. They were of 15 N.H.P. and consumed about 2¼ cwts. of coal per hour. Their hulls were constructed fore and aft ends alike, so as to run either way without turning round. Their engines, with oscillating cylinders by Messrs. Joyce & Co., are said to have been on the compound system, working with high-pressure steam from boilers by Montgomery. Their names were *Ant*, *Bee*, and *Cricket*. The *Cricket's* boiler unfortunately exploded in August, 1847, whilst waiting at London Bridge at the busy time of the day. The boats had two rudders, one at each end, which when not required for use were locked fast and formed part of the hull The *Cricket* is said to have been replaced by the *Sunshine*. These halfpenny fare steamers were greatly patronised by the poorer working classes of the metropolis. The *Endeavour*, built in 1829, by Maudslay & Field, and engined by them with oscillating engines, ran from Hungerford (Market) to Richmond. This pioneer of Thames river steamers was followed in 1835 by the *Fly*, furnished with oscillating engines by Spiller, of Battersea.

(*To be continued.*)

Read at a Meeting of the Institution of Mechanical Engineers, March 20.

The *Times* states that Mr. Phillip Watts, formerly assistant constructor at the Admiralty and at present Constructor at Chatham Dockyard, will succeed the new Director of Naval Constructors as manager of the shipbuilding establishment of Sir William Armstrong & Co., at Elswick.

Instructions have been received at Sheerness Dockyard directing the new composite gun vessel *Swallow*, to be ready for launching in October next. She is the first of a new type of swift gun vessels, and will be provided with eight 5 in. steel breechloading guns. The two foremost guns will be fired from sponson ports on Vavasseur central pivotting mountings, the stern guns will have Vavasseur revolving mountings, and the four broadside guns will be mounted on Vavasseur broadside carriages. She will have a displacement of 1,043 tons, and in this respect will be the largest gun vessel ever designed for the Royal Navy. She will be fitted with machinery of 1,000 H.P. by Messrs. J. and G. Rennie & Co., capable of propelling the vessel at a speed of 14 knots an hour.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—ED. M. E.]

LAUNCHES—ENGLISH.

Icarus.—On July 27th this sloop, sister ship to the *Mariner* and *Racer*, also built at Devonport, was launched from Devonport Dockyard. The keel of the *Icarus* was laid down on August 18 last year. Her length between perpendiculars is 167 ft., while her extreme breadth is 32 ft., and depth of hold 16 ft. 3½ in. She has a displacement of 950 tons. Her draught of water is 11 ft. 10 in. forward and 14 ft. 4 in. aft. Her armament will consist of eight 5-in. breechloading guns, to be placed on the upper deck.

Beresford.—On July 28th Messrs. Edward Withy & Co., West Hartlepool, launched a steel screw steamer from their yard. The vessel has been built to the order of George Horsley, Esq., Hartlepool. She is 295 ft. by 36 ft. 6 in. by 19 ft. 11 in., and will carry about 3,000 tons. She has a long raised quarter deck, short poop, long bridge-house extending to the foremast, and a topgallant forecastle, and is fitted with double bottom on the longtitudinal cellular principle. The vessel has four hatchways capable of admitting large pieces of machinery, &c. There are no beams in the holds, as she has been constructed on the web frame and plate intercostal system. She is also adapted for stowing cotton and timber cargoes. She has also five steel watertight bulkheads, and the main, quarter, bridge and topgallant forecastle decks, bulwarks, rails, skylights, &c., are of steel. She is fitted with two large donkey boilers by Riley Bros., four steam winches and patent windlass by Clarke, Chapman & Co., patent hand and steam steering gear amidships by Davis & Co.; Hastie's right and left hand screw gear aft, with their new guides for the connecting arms; three of Wasteneys Smith's stockless anchors. The vessel is rigged as a two-masted schooner, with iron lower-masts and squaresail yard on the foremast, and built under Lloyd's special survey for the 100 A1 class, and under the inspection of Mr. Barron, marine superintendent. She will be fitted with Messrs. T. Richardson & Son's triple expansion engines of about 1,000 I.H.P. The vessel was christened the *Beresford* by Miss Alice Robinson, daughter of T. Robinson, Esq., West Hartlepool.

Esperança.—On July 28th there was launched one of the steam trawlers for supplying fish to Para, from Bidston Wharf, Birkenhead, by Messrs. Cochran & Co. These vessels are being built to the order of Messrs. Castel & Pontet, under arrangement with the Provincial Government of Para, North Brazil, and are fitted with every appliance for carrying on the projected work successfully. The machinery is also being made by Messrs. Cochran & Co. The launch was in every way successful, and the vessel was named the *Esperança*.

Lightship.—On August 1st there was launched from the yard of Messrs. C. Hill & Sons, Hotwells, Bristol, a lightship, the second of three ordered by the Elder Brethren of the Trinity. The first of the lightships was launched about two months since, and preparations have already been made to commence the third. These vessels are of a costly character, the material used in their construction being oak, teak, and copper, with iron beams and stringers. The length of each is 103 ft., the breadth 24 ft. 2 in., and the depth 12 ft. 2 in.

Bactria.—On August 8th there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt and Co., at Southampton, an iron sailing ship of 2,150 tons nett register, and of the following dimensions:—Length (extreme), about 280 ft.; breadth (extreme), about 40 ft. 6 in.; depth of hold, about 24 ft. 8 in. The vessel is to the order of Messrs. T. & J. Brocklebank, of Liverpool, and receives the highest requirements of both Lloyd's and Liverpool Underwriters' Registry. She is full-rigged. Accommodation is provided in full poop for captain and officers, whilst the petty officers and crew are berthed in an iron deckhouse amidships. The vessel is fitted with Harfield's patent combined capstan windlass for working anchors and chains. On leaving the way she was christened the *Bactria* by Miss Gertrude Mordaunt.

Magnat.—On August 11th there was successfully launched from the yard of Messrs. J. P. Austin & Son, Wear Dockyard, an iron sailing barque of the following dimensions:—Length, 206 ft.; breadth, 33 ft. 5 in.; depth, 19 ft. 3 in.; tonnage gross, 1,010; net, 967. Constructed with full poop, large house for crew, and topgallant forecastle, iron lower masts, lower and topsail yards. To be classed 100 A1 at Lloyd's under special survey. The vessel has been built to the order of Gerd Bolt, Esq., and partners of Elsfleth, and is the third sailing vessel built at this establishment for their firm. As she left the ways she was named *Magnat*, by Miss Newton. She has been inspected by Captain Osterman, who will command her on completion.

Latimer.—On August 11th there was launched by Messrs. W. Gray & Co., from their yard, an iron sailing ship of the following dimensions:—Length, 260 ft.; breadth, 39 ft.; depth, 23 ft. 6 in.; and about 1,800 tons gross. Built to the order of Messrs. J. Lidgett & Sons, London, and classed 100 A1 at Lloyd's. The vessel, which is handsomely modelled, has a full poop, with accommodation for captain and officers and a few passengers, a quarter-deck with chart-house and entrance to saloon, and a large house amidships, containing donkey boiler, steam winch, distiller, &c., and comfortable separate apartments for the crew containing four men each, with large mess-room. The fore part is protected by a topgallant forecastle, under which Emerson and Walker's patent combination capstan windlass is fitted. Linkleter's patent freeing ports are fitted in the bulwarks. A fire-engine pump is placed forward, with pipes leading throughout the vessel. Fore and main double topgallant yards are fitted, and all through she is well found in everything necessary for sailing her and working cargo. She has been superintended during construction by Captain A. C. Graves, who will also take command of her. She is intended for general trading, and is the fourth vessel Messrs. W. Gray & Co. have built for the same owners. The christening ceremony was performed by Mrs. Graves, wife of Captain A. C. Graves, of Exmouth, the vessel being named *Latimer*.

Walter Scott.—On the 13th August there was launched from the yard of the Blyth Shipbuilding Company (Limited), Blyth, an iron screw steamer, built to the order of Mr. Walter Scott, of Newcastle. The vessel is of about 620 tons gross register, and her dimensions are as follows:—Length between perpendiculars, 180 ft; breadth, 29 ft.; and depth of hold, 13 ft. 8 in. She has been built in accordance with Lloyd's rules, so as to obtain the highest class. She is specially adapted for the coal trade, having very large self-trimming hatchways, also wing-boards in the holds, and will be employed in carrying coals from the East Hetton and Trimdon Grange Collieries to London. A double bottom for water-ballast, constructed on the bracket system, extends all fore and aft. The accommodation for captain and officers is provided aft in a short half-poop; the engineers have commodious quarters in bridge-house amidships, while the crew are berthed, as usual, in top-gallant forecastle. The steam winches and donkey-boiler are being supplied by Messrs. Jno. Smith & Sons, of Newcastle. She has also steam steering-gear amidships by Beck, of Sheffield, and a Napier's patent windlass on forecastle deck. As the vessel left the ways she was christened the *Walter Scott* by Miss Scott, daughter of the owner. After the launch the *Walter Scott* was taken round to the Tyne to receive her boiler and engines, which are of 90 N.H.P., by Messrs. Thos. Clark & Co., of Elswick. Both hull and engines have been built under the superintendence of Messrs. Menzies and Blagburn, consulting engineers, of London and Newcastle.

Fé.—On August 14th Messrs. J. T. Cochran & Co., shipbuilders, Birkenhead, launched a steam trawler for the Para Fishing Company, Brazil, at their recently-opened yard at Bidston Wharf, on the Great Float. As the vessel left the ways she was named the *Fé* by Mrs. Poutet, the wife of the manager of the fishing company. The *Fé* is a sister vessel to the *Esperança*, and they are to be employed supplying Para daily with fish. Both vessels are fitted with refrigerating appliances to keep the fish in good condition in a warm climate. The vessels are 90 ft. long, with a 17-ft. beam, and a depth of 9 ft.; have been built of steel, and are supplied with compound surface condensing engines, with the object of economising the consumption of coal.

The *Esperança* is the faster vessel of the two, and is expected to steam about $10\frac{1}{2}$ knots, and the *Fé* 9. The horse-power on the two vessels is 50 and 35 respectively. Under their own steam they proceed to the Brazils, under the command of Captain Poutet.

Alexandra.—On August 24th Messrs. Earles' Shipbuilding and Engineering Company, Limited, launched from their yard at Hull an iron screw tug named the *Alexandra*, built to the order of the Hull, Barnsley and West Riding Junction Railway and Dock Company. The vessel, which is intended for working in the new (Alexandra) dock at Hull, and for general towage purposes, is 72 ft. long by 16 ft. 6 in. beam by 8 ft. 6 in. depth, is classed 100 A at Lloyd's, and is fitted with all the modern appliances of a powerful tug. She has a cast steel rudder of large area, made by Messrs. W. Jessop & Sons, of Sheffield, and a large steam fire engine and salvage pump, fitted in the engine room with suitable connections on deck. A small cabin is provided amidships which will be available as shelter for passengers, and the crew will be housed in cabin aft. She will be fitted by the builders with their triple compound three-crank engines, having cylinders $11\frac{1}{2}$ in., 17 in. and 30 in. diameter by 21 in. stroke, which will be supplied with steam of 150 lbs. pressure, from a steel boiler having two Fox's corrugated furnaces.

LAUNCHES.—Scotch.

Ban Whatt Hin.—On July 27 Messrs. Blackwood & Gordon launched from their building yard at Port Glasgow an iron screw steamer of the following dimensions and particulars, for the Singapore passenger and cargo service, viz.:—Length of keel and forerake, 170 ft.; breadth of beam, 25 ft.; depth in hold, 10 ft. 3 in. Tonnage, gross, about 1100 tons. The seamen and firemen are accommodated in the top-gallant forecastle; the rooms for the captain, officers and engineers being fitted under the bridge deck, and accommodation for the first class passengers in a large house aft. Every attention has been given to the thorough ventilation of the cabins and state rooms suitable for a warm climate. The machinery, which is also supplied and fitted by the builders, consists of compound surface-condensing engines of about 85 N.H.P., steel return tubular boiler, 90lbs. working pressure, two steam winches, donkey boiler, donkey engines, &c. This vessel has been built to the order of Mersrs. E. Boustead & Co., London, for Singapore owners, and the ceremony of naming her the *Ban Whatt Hin* was performed by Mrs. John L. Cuthbertson, wife of one of the partners of that firm. The *Ban Whatt Hin* was contracted for through Messrs. Thomas Skinner & Co., Glasgow, and superintended during construction by Messrs. Mac Nicoll & Co., naval architects and consulting engineers, Glasgow.

Scout.—On July 30th the twin-screw torpedo cruiser *Scout*, built by Messrs. J. & G. Thomson, Clyde-bank, Glasgow, for the Admiralty, was launched. The *Scout*, which is built of steel throughout, is 220 ft. long, 34 ft. beam, 19 ft. depth of hold, and 1,430 tons displacement. The special object which the officers of the Admiralty have had in view in designing the *Scout* is the attainment of a high speed with the power of keeping the sea for a considerable time. The improvements in the forms of ships and propellers which were inaugurated in ships of the *Iris* class and developed in the *Leander* have rendered it possible to produce $16\frac{1}{2}$ knots—the estimated speed of the *Scout*—on a much smaller horse-power than was previously possible. The introduction of forced draught, successfully developed and used in the later ships of the Royal Navy, has also contributed towards the probabilities of success in the Admiralty project, this innovation having rendered it possible to obtain more horse-power for a given weight than was formerly practicable. So great is the latter advantage that the *Scout's* machinery only weighs 2 cwt. per horse-power, whereas that of the *Comus* class, built some six years ago, weighs from $3\frac{1}{2}$ cwt. to $3\frac{3}{4}$ cwt. per horse-power. The improvement in the form of ship and the adoption of forced draught have made it possible to produce in the *Scout* a vessel, 220 ft. long and 1,430 tons displacement, to travel at $16\frac{1}{2}$ knots per hour, and carry coals for seven days' full speed steaming. The *Scout* has twin-screw engines of 2,200 I.H.P. placed in one engine-room, and four boilers of navy type in two separate rooms. A protective deck of $\frac{3}{8}$-inch steel, extending 100 ft. amidships, covers the engines and boilers, and these are further protected on either side by blocks of coal 5 ft. to 7 ft. thick, placed below the waterline fore and aft, where there is no protective deck. The vessel is very minutely subdivided, so that the chances of disablement by flooding are not so great in these parts. The armament will consist of two torpedo tubes in the bow and one in the stern, firing in a line with the keel, also four on each side of the ship on the upper deck, making 11 tubes in all. She has also four 5-in. guns and eight machine guns. The magazines for the ammunition of this small armament are comparatively simple, but they involve considerable care in their arrangement. The vessel has a light schooner rig, which is only intended to steady her. The construction of the vessel is very light, and to give the necessary strength considerable ingenuity has been exercised in substituting elaborate workmanship for the less expensive but heavier stiffening which material gives. She is fitted with S. Baxter & Co.'s patent capstan fittings. The capstan being the latest approved and fitted with a frictional brake similar to H.M.S. *Benbow*, &c, for veering cable and protection to the men at the bars while working it. Messrs. Thomson have six other vessels of the same type in course of construction.

Pearl.—On July 31st Messrs. John Fullerton & Co., Paisley, launched the *Pearl*, a fine iron screw steamer of 515 tons builders' measurement, the owner being Mr. William Robertson, Glasgow. She has been built in excess of the requirements of Lloyd's highest class, and is being supplied with a pair of compound engines of 75 N.H.P. by Messrs. William King & Co., Dock Engine Works, Glasgow.

Barcoo.—On August 10th Messrs. William Denny and Brothers launched from the Leven Shipyard, Dumbarton, a steel screw steamer of the following dimensions:—Length between perpendiculars, 250 ft.; breadth (moulded), 36 ft.; depth (moulded), 24 ft.; gross tonnage about 1,485. The vessel, which, on leaving the ways, was named *Barcoo* by Mrs. John M. Denny, of Dumbarton, is to the order of the Queensland Steam Shipping Company, Limited, and is intended for coasting service in the Australian colonies. She will be classed 100 A spardecked at Lloyd's, and will be rigged as a two-masted schooner. She is built on the structural cellular principle for water ballast, and will be fitted up with accommodation for 90 first-class and 80 second-class passengers. A special system of ventilation will be applied to the passengers' accommodation, and the vessel throughout will be fitted with the electric light. The *Barcoo* will be supplied with direct-acting surface-condensing engines, on the triple expansion principle, by Messrs. Denny & Co., Engine Works, Dumbarton.

Timandra.—On August 10th Messrs. Robert Duncan & Co. launched, from their building yard at Port Glasgow, a handsome iron sailing ship of about 1,500 tons register, for Mr. George F. Smith, of St. John's, New Brunswick, contracted for through Messrs. J. & R. Young & Co., of Glasgow. She was named *Timandra* by Mrs. Andrews, wife of Captain Andrews, late of the clipper ship *Constance*, who will command her. The construction has been superintended by Captain Andrews, in conjunction with Messrs. Mac Nicoll & Co., naval architects and consulting engineers, Glasgow, who drew out the specification to suit the owner's ideas. The dimensions are 245 ft, by 38 ft. 9 in. by 22 ft. 6 in.; and the ship has been built under special survey to class 100 A1 at Lloyd's, with, as follows:—Two decks laid, topgallant forecastle, iron deckhouse for crew, full poop for cabins, &c., with teak chart-house on top forming companion entrance, masts, topmasts, continuous bowsprit and jibboom, and lower and topsail yards, all of steel. Clarke, Chapman & Co's patent windlass, lighthouse forward, hydrant water service, and all the latest improvements. After the launch, she was towed into harbour to be inclined for the stability calculations and fitted out, after which she will load in Glasgow for Sydney.

Malaysia.—On August 11th Messrs. Russell & Co. launched from their Greenock yard an iron sailing ship of 1,900 tons register, and of the following dimensions:—Length, 270 ft.; breadth, 40 ft.; and depth, 24 ft. On leaving the ways the new vessel was named the *Malaysia*. She has been built to the order of Messrs. J. and W. Goffey, shipowners, Liverpool, who have now had a fleet of six sailing vessels built by Messrs. Russell & Co.

Sheldrake.—On August 12th the steel screw steamer *Sheldrake*, built by Mr. W. B. Thompson, of Dundee and Glasgow, to the order of the Cork Steamship Company (Limited), was launched from the Caledon shipyard, Dundee. The *Sheldrake* is the second vessel Mr. Thompson has built for the Cork Steamship Company. The new vessel is about 1,100 tons gross, to carry about 1,400 tons, and has been built of the highest class at Lloyd's. Her dimensions are—Length, 250 ft.; breadth, 32 ft.; depth of hold, 15 ft. 8 in.; her poop deck is 106 ft.; bridge deck, 28 ft; and forecastle deck, 47 ft. Like the other vessels belonging to the Company, the *Sheldrake* has been constructed on what is known as the cellullar bottom principle, which not only

adds to her stability, but provides an inner bottom, which prevents the water gaining access to the hold although the outer bottom is fractured. The engines and boilers, which are from Mr. Thompson's Tay Foundry, are placed well aft, this arrangement permitting an adjustment of the holds whereby the hatchways form an admirable system of ventilation, in addition to the tubes usually fitted for that purpose, which in this case are Boyle's patent. The poop deck extends to the fore end of the boiler hatchway, and under the after end accommodation has been provided for officers and engineers. The space under the bridge deck amidships is occupied by the cabin, which contains rooms for the captain and 14 first-class passengers. On the bridge deck is placed the wheel and chart-house, with an entrance to the saloon. In the wheel-house is placed Higginson's patent steam quartermaster, by which the vessel can be steered either by hand or steam. The crew are berthed forward under the forecastle deck. On this deck is placed Clarke, Chapman & Co's patent steam windlass for working the anchor. At the after end of this deck are two iron lighthouses, in which the ship's side lights are fixed. The poop, bridge and forecastle decks are connected by fore and aft gangways, railed on both sides, thus obviating a descent to the main deck when passing from one end of the vessel to the other. The appliances for loading and discharging cargo comprise four powerful steam cranes on the main deck, and two steam winches placed conveniently to the hatchways. The engines, which are of the compound surface-condensing type, are 160 N.H.P., with cylinders 29-in. and 57-in., with 48-in. stroke, and are expected to drive the vessel at a high rate of speed. Steam is supplied from one steel double-ended boiler at a pressure of 90lbs—that for the cranes, winches, &c., being from a donkey boiler placed on the main deck. When the steamer was leaving the ways she was christened by the Misses Croft, daughters of Captain Croft, Marine Superintendent of the Cork Steamship Company.

Black Pearl.—On August 15 the Culzean Shipbuilding and Engineering Company, Limited, launched from their yard at Douglaston, a steam yacht of the following dimensions:—Length, 158 ft. 3 in.; breadth, 23 ft. 2 in.; depth of hold, 14 ft. 9 in. She is built of steel, to the order of the Earl of Pembroke. She will be supplied with engines and boiler by Messrs. Rankin & Blackmore, Greenock.

Bowman B. Law.—On August 17th Messrs. A. M'Millan and Son, Dumbarton, launched an iron barque of about 1,370 tons nett register, which was named *Bowman B. Law*, after the son of the managing owner, by Miss Moore, of London. The dimensions are as follows:—Length, 232 ft.; breadth, 36 ft. 9 in.; depth of hold, 21 ft. 9 in. She has been built to the highest class at Lloyd's under special survey, and is fitted out in the most complete manner. The vessel is owned by Messrs. William Law & Co., of Yarmouth, Nova Scotia, and will be the first iron vessel registered at that port. Captain Byron Abbott takes command of the new vessel, which is chartered to load for Rio Janeiro.

Linda Park.—On August 18th S. M'Knight & Co. launched from their yard at Ayr a steel barquentine, built to the order of James W. Vallentine & Co., Belfast. The vessel has been designed by Mr. R. Chambers for general trading, and is classed 100 A 1 at Lloyd's, and 21 years A 1* in red at Liverpool underwriters. Her dimensions are:—150 ft. by 26 ft. by 13 ft., and 613 tons deadweight. As she left the ways she was named the *Linda Park* by Mrs. Vallentine, wife of the managing owner.

Screw Steamer.—On August 18th there was launched from the shipbuilding yard of Mr. W. S. Cumming, Blackhill Dock, Monkland Canal, a screw-steamer, 45 ft. by 10 ft. by 5 ft. 8 in. moulded. This vessel is intended for towing purposes, and is suitably fitted up for same. The whole of the hull, including th deck, is of steel, all deck fittings are of teak, and otherwise the vessel is fitted up complete, ready for service. The engines, which are compound surface-condensing, having cylinders of 7 in. and 13 in. diameter, and indicating about 55 H.P., are being constructed by Mr. William Kemp, Govan. This vessel is the second of two similar in all respects which have been constructed by the same builder.

LAUNCH—Irish.

City of Bombay.—On August 12th there was launched from the Messrs. Workman, Clarke & Co.'s yard, at Belfast, a screw-steamer, named the *City of Bombay*, for Messrs. George Smith and Sons, Glasgow, as an addition to their City Line, which trades between Glasgow, Liverpool, London, and Calcutta. The dimensions of the new steamer are:—Length, 404 ft.; breadth, 48 ft.; depth of hold, 29 ft. 2 in.; gross tonnage, 4,500. She will be engined by Messrs. J. & J. Thomson, Glasgow, with engines of 3,700 I.H.P. She is rated 100 A1 at Lloyd's.

LAUNCH—Sweden.

Freya.—On July 25th. the Kockum Engineering Works launched from their yard at Malmö (Sweden) this vessel, a corvette for the Swedish navy. The vessel's dimensions are:—Length between perpendiculars, 221 ft.; greatest breadth, 41 ft.; depth in the hold, 29 ft. Her draught of water aft is, when fully equipped, 19 ft., and forward 16 ft. Her engines are of 1,750 I.H.P., which will, it is estimated, give her a speed of 15 knots per hour. The vessel is built throughout of soft Swedish steel, and cased with two layers of wood—viz., one of teak, 3 inches in thickness, and another of fir, 2½ inches in thickness. The vessel will be fitted with four 15-centimetre and eight 12-centimetre guns. She is the first man-of-war built in Sweden at a private yard, and has taken two and a half years to construct.

TRIAL TRIPS.

Brixham.—On July 24th the new screw steamer *Brixham*, recently launched from the shipbuilding yard of Messrs. Boolds, Sharer & Co., Pallion, Sunderland, to the order of Messrs. F. W. Baddeley & Son, for the Brixham Steamship Company (Limited), Brixham, had her trial trip at sea. She proceeded to sea in the morning to have her compasses adjusted, and this having been accomplished, the *Brixham* was put on trial from Sunderland buoy to Tynemouth light, and also *vice versa*. The result of these two runs, one against and the other with the tide, gave a mean speed of 11¾ knots per hour. The vessel had all water ballast in and bunker coal on board, but no cargo. The engines, which are from the works of Mr. John Dickinson, Sunderland, worked remarkably well throughout the trials. After the trials the *Brixham* left for Newport direct to take in her cargo.

White Rose.—On July 31st the powerful and fast screw steam tug *White Rose*, left Chepstow with a select party for the purpose of proceeding down channel on her trial trip. On arriving in Cardiff Roads she received orders to proceed to Plymouth, where she arrived on Saturday at noon, leaving again at 8 p.m. the same evening with the fine American ship, *Cheesebrough*, 1,500 tons, in tow for Cardiff, where she arrived on Monday morning at 2 a.m., thus proving her ability for long towing, for which she was specially designed by Mr. M. W. Aisbett, superintendent engineer to the owners, Messrs. D. Guy & Co. Her principal dimensions are:—length, B. P. 95 ft., beam extreme, 19 ft. 6 in.; depth of hold, 11 ft. 8 in. She has been fitted by the builders with compound surface condensing engines, having cylinders 20 in. and 38 in. by 24 in. stroke, and a boiler 12 ft. 6 in. by 10 ft., designed for a working pressure of 80 lbs. This is the fifth screw tug built by Messrs. Edward Finch & Co., of Chepstow, for the same firm.

Albert.—On August 1st the *Albert*, one of five twin-screw steamers of shallow draught, built by Messrs Thornycroft, of Chiswick, for service on the Nile, underwent her official trial at the measured mile at Long Reach, on the Thames, with a party of gentlemen from the War Office and Mr. James Dunn, Chief Constructor of the Navy, on board. The dimensions of the steamer are:—Length, 140 ft.; beam, 21 ft.; draught of water, 1 ft. 4 in. forward and 2 ft. 1½ in. aft. The contract speed was 12 miles in light trim. The trial showed that this speed has been greatly exceeded, a mean of six runs on the measured mile giving a speed of 17¼ miles with both screws at work, at 13¾ miles with one screw only. The *Albert* is divided into numerous water-tight compartments, and the machinery is protected by bullet-proof steel plating. The propellers work in tunnels completely protected above and below by the hull of the vessel. The vessel is fitted with triple rudders, which turn her with great ease and rapidity, and is similar in design to the smaller steamer built by Messrs. Thornycroft for the Baptist Mission on the Congo. She is, however, fitted with bullet-proof blockhouses on the lower deck, and is adapted for an armament of machine guns and one nine-pounder.

Coromandel.—On August 1st the screw steamer *Coromandel*, the latest addition to the fleet of the Peninsular and Oriental

Company, went on her trial trip in superb weather. An unusual interest has been centred upon this vessel from the fact that it is the first belonging to the company which has been fitted with triple expansion engines. In nearly every other respect the *Coromandel* is similar in construction to the *Chusan* and the *Tasmania*. According to this new principle she has inverted direct-acting compound triple-expansion engines; there are three cylinders and three double-ended boilers, with a working pressure of 140 pounds steam and 3,200 indicated horse-power. The cylinders are respectively 36 in., 56 in., and 89 in., with 5 ft. 6 in. stroke. The number of furnaces is 25; the condensing surface is 7,000 square feet; and the fire-grate surface 328 square feet. By the adoption of the triple expansion engines an immense saving is anticipated, especially in the fuel department. The principal dimensions of the *Coromandel* are:—Length, 400 ft.; depth, 45 ft.; breadth of beam, 31 ft. 9 in. moulded. Her displacement on a draft of 25 ft. is 8,800, and she carries 4,200 tons dead weight. The gross register is over 4,487 tons, and the net register over 2,649 tons. The vessel has accommodation for 111 first-class and 44 second-class passengers. There are 195,000 cubic feet of clear cargo space, exclusive of large mail and baggage rooms, and there are the most recent appliances for facilitating the easy loading and discharging of cargo. The *Coromandel* can easily be converted into a Government transport, her lower deck being specially fitted up for troops. The steamer has been built entirely of mild steel. She is divided into eight water-tight compartments. The vessel has been built with a straight stem, elliptic stern, and three decks, with full poop and topgallant forecastle; houses on poop for companion, captain's cabin, smoking-room, galleys, &c., and rigged as a three-masted schooner. The poop, main, and lower decks are of steel from stem to stern, sheathed with teak three inches thick, while the top deck has the usual stringers and longitudinal ties sheathed with pitch pine. The vessel is fitted with Hastie's patent safety rudder brake. The construction of the vessel and of her engines has been carried through under the supervision of Mr. W. J. Taylor and Mr. Pettigrew, the company's superintendents, and under special survey at Lloyd's. Both on Saturday and on the day previous, when the official trials were made, the rate of speed attained was about 15½ knots, the guaranteed speed being 14½ knots. General satisfaction was expressed by all those interested, and it was considered that the experiment of the triple expansion principle had proved successful even beyond expectation.

Baghdadt.—On August 7th this steamer, which was recently built and engined by Messrs. Wigham, Richardson & Co., to the order of the Persian Gulf Steamship Co., went on her trial trip. She is 255 ft. long by 34 ft. 9 in. beam, and 25 ft. 6 in. deep, and is fitted with engines of the triplex expansion type, with cylinders, 21½ in., 33 in. and 55 in. diameter, and 39 in. stroke; the boiler pressure being 150 lbs. The following were the results of the trial taken from two views of one knot each; mean speed, 12 knots; mean revolutions, 78; steam pressure, 148 lbs.; vacuum, 29 in. The engines are on Tweedy's patent system, in which the high pressure cylinder is placed centrally. The vessel is fitted with Tweedy's patent condenser, which causes the winches to work more economically and with less noise. Both hull and machinery have been superintended during construction by Messrs. Flannery & Baggallay, of London, consulting engineers to the company, and the trial, which was in every respect successful, was attended by Mr. James Darby, managing director of the company, Mr. Wigham Richardson, and most of the leading consulting engineers of Newcastle.

Amstelstroom.—On August 8th, the new screw steamer *Amstelstroom*, Captain Parlevliet, a superior addition to the fleet of the Holland Steamship Company of Amsterdam, left London on her first return voyage to Amsterdam direct. The *Amstelstroom*, which was built at the works of the Netherlands Company at Fyenoord, is of 900 tons burthen, and has engines of 130-horse power combined. She is now the second vessel belonging to this company, running steamers twice a week between Amsterdam and London, Wednesday and Saturday. Her rate of speed is from 10½ to 11 knots an hour, and the vessel is timed to make the run from Blackwall Pier to the Amsterdam Canal in 16 hours. In the construction of the vessel all the latest improvements, it is stated, have been introduced, and steam power is generally applied in the working of the ship. She has very superior first and second-class passenger accommodation, and the saloon, which is more than usually roomy and well lighted, is handsomely fitted up. The ladies' cabin is also prettily furnished, with every regard to comfort. The same care appears to have been taken in the arrangement of the second-class cabins. The saloon, cabins, smoking and chart rooms, and the quarters of the officers and men are heated by means of steam pipes. The poop deck, of some 40 ft. in length, affords a fine promenade, and there is a platform or bridge to enable passengers to pass forward without going on to the main deck. The vessel has a good capacity for carrying cargo, and she will run regularly on the Amsterdam station. Messrs. Phillipps & Graves are the London agents for the ship.

Torpedo Boat.—On August 13th a sea-going torpedo boat, built by Messrs. Yarrow, of Poplar, for the government, was tried for two hours at full speed at the Lower Hope on the Thames, during which six runs were made on the measured mile. A mean speed of 19½ knots was realised, with an air pressure of only 3½ in., which was perfectly satisfactory to the Admiralty authorities present on the occasion. The boat is the first of a fleet of forty ordered of Messrs. Yarrow and Messrs. Thornycroft at the time of the Russian complications. It measures 125 ft. in length, 13 ft. in beam, and 8 ft. in depth. The whole of the boats, of which this is the sample, are to be provided with one torpedo gun arranged to fire from the bow direct ahead in line with the keel, while there also to be placed on the deck two large revolving towers containing each two torpedo guns fitted to fire over the side, so that the boats will be able to attack a vessel while passing at full speed. Inside each conning tower there will be provision made for steering and navigating the vessel, the advantage being that should, from the enemy's fire or otherwise, one tower get damaged or the officer disabled, the torpedo boat will be under immediate command from the other tower. It is estimated that the new craft will carry coal sufficient for a run of 2,000 miles, at a speed of 10 miles an hour. Below the deck is provision and berthing for twelve or thirteen men, while aft is a saloon for the officers.

Ven-y-va and Va-y-ven.—On August 14th took place the trial of the new twin-screw cargo steamers, built by Messrs. Cochrane and Co., Grovehill Shipyard, Beverley, to the order of Signor Juan B. De Longa, of Bilbao, and engined by Messrs. Cochran and Co., Birkenhead. The vessels proceeded down the Humber, the *Ven-y-va* getting away first, being closely followed by the *Va-y-ven*. The weather was all that could be desired. After running the mile, both vessels went about, and ran the mile against the tide, the speed attained being with the tide 10·2, against 6·6, mean spead 8·4, the estimated speed being eight knots. The owner did not deem it necessary to put the *Ven-y-va* upon the mile, so, after working both steam cranes, the vessels were swung to have their compasses adjusted, which accomplished, they proceeded for a four hours' continuous run, passing the Middle Light, and returned up the Humber. The principal dimensions of these vessels are:—Length, 100 ft.; breadth, moulded, 20 ft.; depth of hold, 9 ft.

Ireland.—On August 18th the City of Dublin Company's new mail steamer *Ireland*, just completed by Messrs. Laird Brothers, made a preliminary trial trip at the mouth of the river, attaining a speed of fully 20 knots. After the trial she was docked in the Great Float, whence she will proceed to Holyhead for her official trials of speed, which will consist of a series of runs across Channel, after which she will be placed on her station between Holyhead and Kingstown.

Amazon.—The *Amazon*, a fine steam yacht of the following dimensions, built by Messrs. Day, Summers & Co., of Northam, to the designs of Mr. Dixon Kemp, has lately run a trial in the Solent with very successful results. The length on low-water level is 83 ft.; beam, 15 ft. 6 in., and displacement 77 tons. The engines are compound condensing, with cylinders 10 in. by 20 in. in diameter by 16 in. stroke. The boiler is 8 ft. in diameter, and 7 ft. 6 in. long. The grate area is 24 square feet, and the heating surface 509 square feet. The propeller is 6 ft. in diameter, with 7·1 ft. pitch, the blade surface being 8·5 square feet. With 100 lb. pressure, and 26 in. vacuum, and 164 revolutions, 124 H.P. was developed, the speed being 10·49 knots. The draught was 8 ft. 3 in. aft, and 5 ft. 6 in. forward. The yacht is unusually fine aft, and is a very handsomely modelled craft.

Another ship of the *Scout* class is to be laid down at once in Devonport Dockyard. She is to be built from the *Serpent's* drawings. She will be 225 ft. long, 3,500 H.P., and will have a speed of 16 knots. The armament is to be four 6 in. breechloading guns on her poop and forecastle, two 6 in. breechloaders on the upper deck, and eight Nordenfeldt guns, besides the usual torpedo equipment.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

THE POSITION OF MARINE ENGINEERS.

To the Editor of The Marine Engineer.

Sir,—The letters that have appeared on "The position of marine engineers" have I think attached too much importance to such points as the questions in the examination paper, "How long have you served as fireman or trimmer;" "The appointing of firemen and pattern-maker's to serve as engineers;" and "The granting of certificates in steam to captains;" all of which, though very objectionable, are I think not the main reasons why our position is so unsatisfactory, and I would like to draw attention to others, which I think do more harm. One is the habit that many engineers have after they join a ship of speaking ill of the man who has preceded them, such phrases as "the engines were all in pieces;" "the boiler was salted up;" or "the engines were working like forge hammers," are often used, and as a rule without much cause. When it is the superintendent who hears it little harm is done, as the chances are he has heard much the same from the last engineer who was in the ship, and will not be astonished if the next one talks in the same way, but when it is the owner or captain, I need hardly point out that it is calculated to do much harm. Even if things are not in the best of order, surely regard for the class we belong to should keep us from furnishing captains and owners with another of their favourite stories about incompetent engineers; while not talking so much will not hinder anyone from showing his ability by getting better results from the machinery. Another cause is the dissipated habits of some of our number; though they are few in number, they do an immense amount of harm, and we will never be able to take our proper positions while such men go to sea. Chief engineers can do much to bring about an improvement in this respect, by care as to the character of the assistants they engage, and by only recommending those for employment who are worthy of it. The importance of our duties, is, I think, generally admitted, and it is only requisite for us, as a class, to perform them well and have a proper self-respect, to take a much better position than we at present hold.

An Old Chief.

Newcastle, August 13th, 1885.

FAST RIVER STEAMERS BEATEN BY A STEAM YACHT.

To the Editor of The Marine Engineer.

Dear Sir,—In your issue of the 1st August, you give an account of a fast river steamer beaten by a steam yacht; you state the yacht was designed and built by the Herreshoff Manufacturing Company, of Bristol, is 24 ft. long over all, 90 ft. on the water line, 11 ft. beam, and only weighs 28 tons. Now, there must be a mistake in some of these figures; if. she is 24ft. long, how can she be 90 ft. on the water line. Will you kindly explain the discrepancy, and whether you can speak with confidence that she ran the distance of 30 miles in one hour and a quarter.—Your obedient servants,

H. E. Moss & Co.

83, *Gracechurch street, E.C., August 4th*, 1885.

[The 24 ft. referred to is an error, and should have been 94 ft.; we believe the statement respecting her speed to be correct. —*Ed.* M.E.]

VOLUNTEER COAST DEFENCE.

To the Editor of The Marine Engineer.

Sir,—I think from the article on the above subject, published in your issue of the 1st inst., that you are under some misapprehension as to the views and objects of the Naval Volunteer Home Defence Association. The reason why the Association considers that private enterprize may rightly be employed in the defence of our coast towns and home posts is, because in a time of war the whole of the naval force of the country must necessarily be concentrated on the one object of meeting and destroying the enemy wherever he may be found, and where he is most seriously to be hurt, and that, until we have such a naval force at sea as to make it impossible for an enemy to show himself in the open, it is better for the Admiralty, as far as possible, to relieve their minds of the duty of providing against isolated and, from a national point of view, insignificant attacks on towns and ports at home. Places like Hull, Glasgow, Newcastle and Liverpool, mentioned in your article, are more or less of imperial importance, and Government money may very well be spent on their defence; yet an attack on Liverpool might very possibly be best met by sending ships to Toulon, and it would be very foolish to keep a ship at Liverpool when she was wanted at Toulon. At present too, the country has not sufficient ships to guard our mercantile marine and keep the highways of the sea clear. England is now, therefore, most vulnerable through the obstruction of her commerce. The life of the nation is its ebb and flow; if this is checked in any way, even for a time, the nation dies; therefore, the Association recognises that it is the main duty of the Amiralty not to withdraw their attention from guarding this free and uninterrupted flow. But, whatever the Admiralty may do, even should the taxes be increased so as to double the size of the Navy, it is almost certain that in a time of war, small vessels (privateers and other cruisers) would occasionally, if not frequently, slip past our fleet, and press on towards the exposed towns for the purposes of committing depredations on shipping, or extracting subsidies by threats of bombardment. It is this danger, and almost this danger alone, that local authority can be properly called on to meet, whereas with the Government will very properly lie the obligation to prepare against large attacks on our principal ports.

The Association rests very strongly on the idea that most Englishmen, in the matter of putting their hands in their pockets, would rather be led than driven, and it considers that they do so because, when it comes to the question between raising the naval estimates for the purpose of providing coast defence by the force of the tax-gatherer, or asking them to use their own common sense and business capabilities in the defence of their country, contributing the funds in a voluntary manner; they will at once decide for the latter.

It is a coincidence worthy of note, that while England has a military volunteer force of (including yeomanry) over 300,000 men, which would never be required unless the country were invaded, she has only 1,400 naval volunteers to prevent that invasion—a matter of much greater importance; and naval officers loudly complain of this want of development of the naval spirit of the country.

These then, Sir, are some of the reasons why the Association invites the co-operation of the localities in the work it has undertaken, and to such of your readers as yet think that a case has not been made out for voluntary effort. I would say that even if in their opinion it is work the Government should do, will they not recognize the fact that the Government has not done it, is not doing it, and refuses to do it in the future? In practice then, it is Hobson's choice—defence by voluntary effort or no defence at all. In proof of the assertion that the Government will not undertake the work, I have only to point to the following admittedly inspired remarks by the late Senior Naval Lord of the Admiralty, and the Inspector General of Fortifications of the Army, delivered at Willis's Rooms on the 2nd July last, as the Liberal opinion on the matter, viz., by Admiral Rt. Hon. Sir Cooper Key . . . "I may say that my late chief, Lord Northbrook, had expressed his intention of attending the meeting if in town, and of giving his opinion in favour of it also. The first question of importance that I think not only this meeting, but the public should fully understand, is that the actual local defence of our ports cannot and ought not to be left to the Royal Navy." . . . "First of all, begin by building small vessels that you will require, at the same time turning to the Admiralty to provide or recommend you properly nstructed officers and men to train the men required to man them." . . . By Major General Sir Andrew Clarke:—"Holding a most responsible office in relation to the defences of the Empire, my presence on this platform to-day with the sanction of the Secretary of State will, I think, be some assurance to you that the movement we are endeavouring to promote meets with the sympathy of Her Majesty's Government." And as the Conservative view to the following extract from Lord Harrowby's

speech in the House of Lords on the 17th July:—"Our ships of war would not be at the disposal of our commercial ports and harbours, they would be occupied in shutting up the enemy in their own ports; they would be engaged in the most important office of convoying our great merchant fleets, and also in the important duty of watching our scattered colonies all over the world, and this over and above any aggressive action that might necessarily be taken." . . . "He asked their Lordships to consider how it would be possible for Her Majesty's Government, with any idea of the most ordinary economy, to undertake the defences of all the commercial ports and harbours of the country? He believed the expenses would be so enormous that they could not expect the House of Commons or the country to agree to it. The Government had, therefore, come to the conclusion—though it was early to announce a definite policy—that they must rely to a great extent upon the localities for a very serious part of the work, not only on grounds of expenses, but because they believed the localities would do the work better and cheaper for themselves." . . . "The present opinion of the Admiralty, after taking the best advice, was that they ought to rely upon support other than that of the Government; and they hoped that the localities and patriotic associations would be able to supply material for the movement. With regard to the second requisite—men—the great object would be to have trained men to work the torpedoes and gunboats, and for that purpose the Government would wish to give every possible encouragement to the creation of Naval Volunteer Corps."

In conclusion, I would remark that Sir Cooper Key does not absolve the Navy from defending the coast towns of England, but he thinks the coast towns of our enemies are the right places for the Admiralty to exercise its proper powers of defence.—I am, Sir, faithfully yours,

THE HON. SECRETARY.

Naval Volunteer Home Defence Association,

31, Spring Gardens, S.W., 13th August, 1885.

TORPEDOES.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—Thanking you for the very impartial way that you fearlessly direct the careful attention of your *practical* class of readers to all subjects that seriously affect the preservation of the peace of the United British Empire, independently of court favour, official humbug, or vested interests, allow me as briefly as possible to correct, if possible, some very popular errors in regard to the revival of the old and almost obsolete *exploded* (?) systems of torpedoes of *long ago*. In order to fully understand the whole question of torpedoes, torpedo launches, and torpedo warfare, and to simplify the solution of the whole difficulty of "*disposing of them*" in both senses, allow me to state it appears only necessary to call them by their otherwise well-known proper names, of military *mines*, military "*grenades*," Danby or Congrieve "*rockets*," *fire-ships*, or live bomb-*shells* on the *thin* end of a *long stick*, and the solution becomes "as *clear* as mud in a wine glass;" *i.e.*, *in actual demonstration*. Hence a very little practical consideration will fully convince every one of your practical readers *that will take the trouble to think*, that a good combination of grenades, mines, rockets, or shells, as fish or fowl—torpedoes or *diving ducks*, can be applied with numerous modifications *to protect or destroy* any *armed vessel or harbour institutions*, and common sense must naturally prefer to adopt the already-made existing *weaker vessels*, properly strengthened and scientifically fortified, than fly to greater evils that "*they know not of*," of *problematical* utility but *undoubted* costliness, complication, and unseaworthiness—*verbum sat sapientis*. Therefore, a very superior class of swift screw-steamer (commercially useful), *lighters for coasting trade*, armed merchant cruisers, adapted both for peace and war, *pleasure steam yachts* of the utmost possible speed, can *be already* designed, and may be sent, on approval, as *pilot boats*, war vessels, or *despatch boats*, &c., and even those vessels *that are especially adapted for stormy seas*, viz., *the whaleboat or the lifeboat*, are actually now proposed as the armed vessels of the future, that can be equipped at a day's notice, with longer guns of longer range (new machines and breechloading), with self-packing, self-contained automatic torpedoes, that women and children can handle promptly. Kindly invite discussion, and oblige yours sincerely,

GEORGE FAWCUT.

Genoa, August 13th, 1885.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from July 21st to August 20th, 1885.

8790 W. Scantlebury. Propelling ships.
8802 Newton (G. D. Barney). Dumping boats.
8803 W. Noble & A. Mackie. Boiler furnaces.
8804 W. Noble & A. Mackie. Boiler furnaces.
8807 Boult (C. W. Stuart). Compasses.
8821 Lake (W. H. Tolhurst). Centrifugal machines.
8829 C. B. Phillips. Construction of war-vessels.
8864 P. G. B. Westmacott. Hydraulic apparatus for lifting heavy boats from the water.
8895 H. C. Bull. Electric pilot for navigable vessels.
8918 T. Cain. Steam and hand-power net hauling machine.
8936 C. Colwell. Steering ships.
8951 D. Johnson. Manufacture of explosives.
8956 B. Meyer. Devices for presenting the explosion of steam boilers.
8959 E. F. Piers. Governing the speed of engines.
8960 E. F. Piers. Governing the speed of engines.
8972 C. H. Ancill. Taps or cocks.
8996 T. Nordenfelt. Carriages for machine guns.
9002 J. Mitchell & J. Sinclair. Cartridge.
9003 J. Mitchell & J. Sinclair. Limiting the effects or extent of explosions.
9023 Newton (A. Nobel). Explosive compounds.
9027 Brookes (C. H. Gerson). Cocks or valves.
9040 R. Scott. Propelling torpedoes.
9041 R. Edwards. Triple expansion steam engines.
9051 W. Hopwood. Rotary engines.
9065 Haddan (W. H. Craig). Steam engine lubricators.
9070 H. Otway. Steam engines.
9080 R. D. Bowman. Tip valve gear.
9081 W. Ross. Packing for cylindrical surfaces.
9100 J. Davison. Friction clutches.
9101 J. B. Fenby. Appliances for cooling and softening the fouling in gun barrels.
9102 R. Scott. Naval rams.
9104 R. Watson. Steering vessels which have lost their rudders.
9018 A. O. Jones. Armour plating.
9125 Newton (A. Nobel). Manufacture and use of explosive substances.
9126 Newton (A. Nobel). Manufacture and use of explosive substances.
9130 C. Davy. Valve gear for steam hammers.
9132 Lake (Brown's Seamless Metal Company). Propeller and other shafts.
9135 J. Clissold. Rotary engines.
9144 C. Humbolt. Motor.
9153 W. H. Wheatley & J. W. Mackenzie. Steam engines.
9156 E. L. Berthon. Indicating the trim of ships.
9161 S. W. Snowden & F. Tolkien. Effecting a forced draught.
9164 B. Russ. Compasses and binnacles.
9173 A. Bradshaw. Fitting of water gauges.
9175 J. Millington & H. Jones. Boilers.
9176 W. Foster. Taps and cocks.
9177 H. Morton. Raising gigs.
9179 R. C. Sayer. Pneumatic motor.
9185 W. B. Thompson. Air pump and other valves.
9194 H. Cogan. Oil cans.
9195 J. Dewrance. Light feed lubricators.
9201 S. Fox. Construction of fire boxes of steam boilers.
9203 J. Robbins. Artificial fuel.
9218 W. H. Wheatley & J. Mackenzie. Steam engines.
9229 J. Woolven. Rocket life-saving apparatus for fire.
9234 M. Coulson. Heating, purifying and softening water for boilers.
9238 Gessner (E. Gessner). Condenser carding engines.
9267 F. E. Rainey. Automatic feed water regulator.
9276 R. Munn. Ships' downcast ventilators.
9278 M. Stephenson. Coupling and uncoupling of steam pipes.
9282 G. McCall & W. B. Cumming. Rudder brake.
9299 W. Ross. Construction of engine.
9307 Boult (E. Swindell). Construction of vessels.
9312 Boult (Z. Orem). Construction of vessels.
9316 Wise (J. G. Hänsel & F. L. Krumbiegel). Furnaces.
9318 H. Salamo. Rotary pump.

9320 E. F. Piers. Governing the speed of engines.
9329 A. J. Rath. Neutralising the effects of collisions at sea.
9335 J. Hookham. High pressure taps.
9336 J. Hookham. Ball valve.
9338 W. A. Martin. Developing and increasing the draught of furnaces.
9342 W. H. Wheatley & J. W. Mackenzie. Steam engines.
9356 R. Morris. Adapting breechloadng guns for practice.
9366 J. Magnee & E. Benekens. Fire grates for boilers.
9393 J. F. Meyjes. Valve gear for double acting engines.
9395 Lake (R. Cox). Compound steam engines.
9407 J. G. Smeaton & T. Macgregor McDonald. Multiple regulating and indicating valves.
9409 J. Gordon & G. Lowden. Automatic sounding apparatus for ships.
9431 L. W. Leeds. Boilers.
9444 Thompson (Don Francisco de Sales Alvarez de la Reguera y Muniz). Steering vessels in case of accident to the rudder.
9467 E. P. Preston. Pumps.
9472 C. E. Austin & W. Burchell. Driver for vessels.
9485 C. H. Cooper. Pistons.
9501 J. Davies. Anchors.
9503 J. Pembery. Facilitating the propelling of canoes.
9506 J. R. Fothergill. Pressure reducing valves.
9513 A. Kellet. Directing or guiding steam and other vessels through the water.
9514 J. Bernstrom. Solid drawn cartridge.
9533 W. Child. Construction of oil feeders for lubricating machinery.
9535 J. B. Secor. Automatic ship berths.
9540 B. Dickinson. Screw propellers.
9547 J. Appleyard & J. Johnson. Construction of ships, boats or vessels to prevent rolling.
9551 Gunn (The Coal Economising Company). Compound for the prevention of smoke in furnaces.
9565 A. F. Martel. Mechanical motors.
9582 J. H. Adamson. Gearing.
9586 W. H. Prestwich. Apparatus for navigating or propelling boats or vessels.
9595 C. J. Murton. Hauling apparatus.
9598 R. Morley. Rotary motive engines.
9604 S. E. Saunders. Boat building.
9613 H. Kottgen. Steam engine and boiler.
9620 R. W. Taynton. Process for seasoning timber.
9624 G. H. O. Hamerton. Propelling marine mechanism by condensed atmospheric pressure or combinations.
9634 D. B. Morrison & H. Cheesman. Torpedo nets.
9647 R. E. Harris. Finding the variation and deviation of the compass. To be called the aziometer.
9656 U. M. Smith. Apparatus for shaping or cleaning engine or machine work.
9657 J. Mayer. Self-lubricating piston.
9658 T. A. Wheatley. Construction of valves.
9672 T. Nordenfelt. Range finders.
9674 J. Sandeman. Mariners' compasses.
9675 H. F. Smith. Bearings and couplings for shafts.
9678 W. Ford. Apparatus for loading cartridges.
9681 J. Ellis. Propelling and steering ships.
9682 W. Fitton & A. Gillespie. Oil cans.
9704 J. D. Morrison, sen., & T. J. Robson. Manufacture of corrugated flues.
9705 Lake (G. Bianchi). Ships' sails.
9718 J. Beveridge. Expansion gear.
9724 J. McGill. Lubricating journals.
9725 R. W. Anderson. Consuming smoke.
9727 W. Laing. Packing for pistons.
9728 A. Ferguson. Equilibrium slide valve.
9735 Allison (J. S. Hall). Feed lubricator.
9743 Guggenheim (G. Allweiler). Force pump.
9744 M. P. W. Boulton. Generating and heating steam.
9767 A. Priest. Valves.
9787 H. Turner. Tube plates of steam generators.
9788 W. H. Poole. Binnacle pedestals for rotary shafts.
9806 H. Fisher. Filtration of smoke.
9816 Lake (C. H. Hersey & F. C. Hersey). Pumps.
9817 Fwynne. Incandescent electric lamps for burning under water.
9821 G. Wilson & J. A. Timms. Safety valves.
9844 L. Mills. Reciprocating rotary engines.
9848 J. Hill. Gas furnaces for steam boilers.
9849 F. A. Paget. Mariners' compass.
9852 J. Kirkaldy. Feed water heaters for boilers.
9857 Lake (R. R. von Walcher-Uysdal). Barometers.
9859 C. W. Worrell & F. Podger. Machine guns.
9860 E. T. Perken. Clinical theremoters.
9862 T. Murphy. Valve cock.
9871 J. Clyne. Valve ports of steam cylinders.
9889 W. Cameron. Steam engines.
9895 A. Lovell. Lubricating compound.
9906 J. Richards. Device for use with rifles of machine guns.

BOARD OF TRADE EXAMINATIONS.

Note.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

July 25th, 1885.

Ashton, H. H. ..	2C	Cardiff
Campbell, John ..	2C	Liverpool
Charles, William.	2C	Cardiff
Coomber, Thos...	2C	,,
Davis, E. M. ..	1C	,,
Davis, J. P.	2C	Belfast
Dwerryhouse, W.	1C	Liverpool
Edwards, John ..	2C	Cardiff
Farrish, R.	2C	Liverpool
Hall, E. J.	2C	Sunderlnd
Jones, William .	2C	Cardiff
Keay, A. G.	2C	Dundee
Kitchen, A.	2C	N Shields
Latimer, J. James	2C	Cardiff
Leary, Michael ..	1C	,,
Mann, W. A. ..	2C	Aberdeen
Moverley, Robt. .	2C	Cardiff
Murleyley, Thos.	2C	,,
Myers, J. R.	2C	London
Newborn, James .	2C	Cardiff
Owen, Jenkin ..	2C	Cardiff
Power, John Jas.	2C	,,
Ryder, C. L.	1C	N Shields
Smith, T. B.	2C	Cardiff
Taylor, Geo. S. .	2C	,,
Taylor, Stephen .	2C	,,
Tomlinson, J. H.	2C	,,
Wallis, S. T.....	1C	London
Whelpdale, J. W.	1C	Sunderlnd
Wilkin, H.	2C	N Shields
Wright, A. H. ..	2C	Cardiff
Young, John A.	2C	,,

August 1st, 1885.

Andrews, X.	2C	Liverpool
Baird, John G. ..	1C	,,
Bowden, J. A. ..	2C	London
Bullock, A.	2C	Liverpool
Christie, H. R...	1C	Hull
Hooper, Wm. B.	1C	Liverpool
Linton, Peter M.	2C	Hull
McCall, G. W...	1C	Liverpool
McLachlan, D...	2C	,,
McPhee, Edwin..	2C	London
Moore, Wm. H.	2C	,,
Paul, Arthur A.	2C	,,
Roberts, Chas. E.	1C	Liverpool
Sneath, A.	1C	London
Smith, Robt.	2C	Liverpool
Sumner, W. F...	1C	Hull
Warriner, C. R.	1C	Cork
Willet, L.	2C	Liverpool
Williams, Wm. G.	2C	Liverpool

August 8th, 1885.

Adams, Duncan .	2C	N Shields
Almond, A. N. ..	2C	,,
Almond, Walker.	2C	Leith
Baker, James ..	2C	Liverpool
Barbour, John ..	1C	Glasgow
Bell, Alex.......	1C	,,
Brown, Joshna ..	2C	N Shields
Brown, William .	2C	Leith
Calder, Alex	2C	,,
Cunningham, A.	2C	Liverpool
Dixon, William .	1C	,,
Finlay, John	2C	Leith
Garrett, Wm. L.	2C	Liverpool
Halliday, James .	2C	N Shields
Hamlen, Charles	1C	Liverpool
Harle, William..	2C	N Shields
Henderson, Alex.	2C	Leith
Hutton, James ..	2C	,,
Ireland, Griffiths	1C	,,
Jackson, Peter ..	2C	Glasgow
Leitch, Andrew .	2C	Leith
Mackenzie, J. B.	1C	,,
Marshall, Wm. R.	2C	N Shields
Prentice, John ..	1C	Leith
Pritchard, H. ..	2C	Liverpool
Smith, Arch.	2C	Leith
Sedgwick, Wm.	2C	N Shields
Stewart, William	1C	Glasgow
Storrier, A. B. .	1C	Leith
Yule, Alex.	2C	Glasgow

August 15th, 1885.

Bailie, Martin ..	1C	Dublin
Bingham, George	1C	Leith
Borrone, S. F. ..	2C	London
Bowler, Charles..	2C	Liverpool
Campbell, Geo...	1C	Glasgow
Cantwell, A. J...	2C	Southamt
Evans, Owen ..	2C	Liverpool
Foggo, John M.	1C	N Shields
Glass, John	1C	Glasgow
Godsell, F.	2C	London
Gordon, James ..	1C	Glasgow
Gray, Alex	2C	,,
Greenless, John..	1C	,,
Harvey, John ..	2C	,,
Harvey, Robert..	1C	Dublin
Jack, John	1C	Glasgow
Kermode, James	2C	Liverpool
Larmont, John ..	2C	N Shields
Lindsay, William	1C	Glasgow
Mace, James D.	1C	London
McFarlane, Peter	1C	Glasgow
McIntosh, Wm...	2C	Glasgow
McMutrie, Thos.	2C	London
Newdick, Herbert	2C	Hull
Shearer, Chas. ..	1C	Glasgow
Skinner, Edward	2C	W Hartpl
Smith, J. Thom.	1C	Glasgow
Telfer, H.	2C	N Shields
Watson, Alex. ..	2C	Glasgow
Wilson, John ..	1C	Leith
Woldemar, A. J.	2C	Greenock
Young, T.	1C	N Shields

The Marine Engineer.

LONDON, OCTOBER 1, 1885.

EDITORIAL NOTES.

MESSRS. LAIRD BROTHERS, of Birkenhead, have scored an undoubted success in one of their last productions, namely, the City of Dublin Steam Packet Company's new mail steamer *Ireland*, which is not far from being—if not quite—the fastest ship afloat. She attained the unprecedented speed of 20·25 knots, or 23·344 miles an hour on her proper sea course from Holyhead to Kingstown, which is a very different thing to a trial trip on a measured mile in smooth water. This is very cheering news for a nation such as ourselves, who desire to maintain the lead in the shipbuilding world, and especially in comparison with the dismal failures in steam shipbuilding that our American cousins have lately been making. It is also gratifying to find an Irish company showing such commercial enterprise and good common sense, in supporting the privilege they now possess of carrying the Irish mails, by providing for the service a vessel which is at present entirely without a rival in British waters for speed and comfort. Messrs. Laird Brothers must be heartily congratulated upon the results, and we trust that in the present slack times this magnificent success will serve to fill their yards with further orders. It seems difficult to apportion the praise more to the building of the hull than to the design and workmanship of the engines. Each seems to be commendable in its way. The hull seems admirably built, not only for speed, of which we have such excellent testimony, but is cleverly constructed to prevent seas washing over her bows and to roll easily, which she is said to do with exceptional comfort to the passengers. The cylinders are 102 in. in diameter by 8 ft. 6 in. stroke and the crank pin is $24\frac{1}{2}$ in. in diameter. These dimensions may serve to give some idea of the tremendous size of the engines; each paddle-wheel weighs 55 tons, and they are splendidly set out and designed for true feathering, so that little or no surf is raised, which makes an entire absence of that thrashing which is so commonly heard with badly designed wheels. This vessel is also a good illustration of the fact that the best design for engines and boilers depends very much upon circumstances, and it may strike engineers as somewhat curious that the fastest sea-going steamer in the world should be propelled by non-compounded engines, working with low pressure steam, jet condensers and sea water. It is probable that equally serviceable results could not have been obtained under any other circumstances. The weight of a surface condenser would be normally greater than that of the jet condenser, and large as is the diameter of the present cylinders, a low pressure compounded cylinder would probably have had to be much larger. If any saving had been effected in the cost of fuel it would have proved such a comparatively insignificant item, for the short length of the voyage, that it would not have compensated for corresponding drawbacks. The salt water, moreover, is no disadvantage in the present instance. The superintendent uses a composition which throws down the lime and magnesia salts as mud, which is readily blown out. The boilers are not, as a rule, blown off at all while at sea, but are conveniently blown down at the end of each trip, and filled up again, so as to utilise the heat of the boilers. The vacuum produced by the jet condensers is excellent, being over 13 lbs. to the square inch throughout the trip, a result which could not easily have been attained with surface condensers without enormous weight and large condensing area. We have but one criticism to make upon the engines, and that is that the engines depend for their rigidity too much upon the framework of the vessel, not being provided with a bed plate proper. This is likely, in very rough weather, to cause a certain amount of straining in the bearings, and consequent serious heating in the journals. No doubt there were excellent reasons for adopting this method of construction, but it is, to say the least, an unfortunate drawback to so perfect an engine.

THE controversy as to the best lighthouse illuminant still seems to be unsettled. It will be remembered that some little time ago a considerable amount of unpleasant feeling had arisen among the experts employed in experimentally testing the question, leading to the resignation of one of the most prominent scientists of the day. The illuminants in question are oil, gas, and electricity; and the question has, unfortunately, acquired a personal character, from the fact that the Trinity House advocates, whilst at the same time it seems to have a very strong prejudice in favour of, the use of mineral oil; the Irish Commissioners of Lights have, on the other hand, in the face of great opposition from Trinity House, employed gas, with very great success, in most of the chief Irish lighthouses. We have now before us the long-expected report of the Trinity House on the experiments which have been made at the South Foreland Lighthouse on this subject. The experiments have occupied a long time in their prosecution—namely, twelve months, and the pre-

paration of the report has occupied another five months, so that much might well be expected from the result. Although there is a great deal of useful matter embodied in the report, the result as a whole is disappointing, since Trinity House seem either not to believe the results of their own experiments, or to wilfully shut their eyes to the deductions to be drawn therefrom. This is the more to be regretted, since in consequence of the dissolution of the original Illuminants Committee, which comprised a great number of independent scientists, Trinity House accepted from Mr. Chamberlain the sole control of the experiments, and they should in such case have been very careful to avoid any appearance of partisanship. As technical results, they attribute to the electric light the greatest power to carry to the farthest distance, and to penetrate fog, though, it would appear, they have not in these experiments adhered to the ordinary conditions under which a lighthouse has to work—namely, that of a constant focus. In comparing the illuminating power of gas and oil, they found the Wigham 108 jet burner to give the highest illuminating power—namely, 2,923 candles, as tested at Haisborough. The oil lamp tried in comparison with this burner gave, according to the report, an illuminating power of only 722 candles, which seems to leave it entirely in the background. This result in itself, to an outsider, seems conclusively in favour of gas, as it is scarcely likely that the shipping public would admit the question of economy in comparing the cost of mineral oil and gas to weigh in comparison with the best light that can be obtained.

The awards of medals at the International Inventions Exhibition seem to have given very general dissatisfaction to all the exhibitors. In fact, it is difficult, from an outsider's point of view, to account for the obvious passing over of the most meritorious inventions in all classes in favour of wealthy firms, who are in no way patentees or inventors at all, nor even exhibitors of anything strikingly new, unless the order of donations to a certain testimonial fund—sent round for subscription at the time when the jurors were commencing their labours—has any thing to do with the matter. We should be sorry to think either this or any similarly improper consideration has had any weight with the jurors; but some of the inconsistencies are almost too glaring. It has been common talk in the printing department, that one of the most striking novelties of the day in printing machinery, namely, Godfrey's new patent platenprinting machine, was awarded only a bronze medal, on the same footing as the well-known boy's plaything, the "Model" printing press, between which there is no more similarity than between a breechloading rifle and a child's popgun. In our own department of marine engineering, Messrs. Durham, Churchill & Co. seem to have good ground to object to the award of a silver medal which has been given to them for their patented governor, which is so universally appreciated among marine engineers.

Messrs. Durham, Churchill & Co.'s objection is based not merely on a question of obvious superiority, in which we may presume they may be somewhat biased, but on the technical grounds that Mr. David J. Dunlop, to whom a gold medal was awarded, had not fulfilled the specified conditions of exhibition competition, or, in short, is not a qualified exhibitor at all. If an exhibition of this kind is to be conducted upon rules at all, it is obviously necessary, as in the case of all other competitions, that the conditions of such competitions shall be rigidly adhered to, in order to afford fair play to the competitors. Now, it seems, from Messrs. Durham, Churchill & Co.'s statements, that David J. Dunlop's name, as an exhibitor, does not appear in either the first or second editions of the official catalogue of the exhibition, nor is there any reference of his governor as being exhibited by any other person. They further believe that Mr. Dunlop's governor was not in the exhibition at all until several weeks after the jury had been at their stand. Should these facts be as Messrs. Durham, Churchill & Co. state them to be, and which we have every reason to believe, it is a most serious oversight on the part of any jury not to first ascertain before an award is given, whether such competitor is duly qualified or not. Messrs. Durham, Churchill & Co., like other exhibitors whom we could mention, have had a good deal of correspondence with the President of the Executive Council and the Secretary of the Jury Commission of a most unsatisfactory and indefinite character, though we cannot but fear that this is very natural, as it is a most unsatisfactory business to attempt to interfere with jury awards.

We have just had an important addition to our Navy in H.M.S. *Scout*, launched by Messrs. Thompson from their yard at Clyde Bank, which has passed very satisfactorily through all its trials. There is a strong feeling amongst all shipowners, and the nation at large, that in our efforts to produce the most powerful and formidable ironclads, we have neglected to provide rapid cruisers which would serve to defend our commerce in case of war. The *Scout*, however, is a first instalment of a comparatively cheap but very serviceable cruiser, with a

torpedo armament of eleven separate torpedo ejectors, and she does great credit to her builders, Messrs. Thompson, who, we understand, have been entrusted with a further order for six similar vessels. We are glad to note this proof, that the nation may be best served by entrusting their orders for ironclads and cruisers to private firms of standing and repute. The *Scout* has 1,450 tons displacement, and is 220 ft. long between perpendiculars, with 34½ ft. extreme breadth. The hull is built of steel throughout, and the bulkheads necessary for the minute subdivision of the whole have been worked up as integral portions of the structure, giving great strength and stiffness to the vessel. Steel has been used for the crank propeller shaft, the piston rods, cylinder liners and framing; and as an I.H.P. of 3,700 was obtained from machinery not much exceeding 300 tons, the result must be considered very satisfactory. On the trial, with a mean H.P. of only 3,200, the vessel attained a speed of 17.3 knots per hour, which could be increased to 18 knots when pushed. This speed would enable the vessel to run away as she liked from any formidable ironclad with whom she might fear to cope, and, knowing this, we imagine the *Scout* would prove, with her formidable torpedo armament, an exceedingly awkward customer for even the heaviest ironclad. This vessel is a great improvement on the *Iris* and *Mercury*, as her armament is in many respects more formidable, whilst her speed is very little less, and at least four vessels of the *Scout* type could be produced at the cost of the *Iris*. This is excellent evidence of the steady advance and improvement in the designs and types of the Admiralty, in spite of the dirt that is constantly being thrown at them as remaining stationary, without any effort for improvement. As a mark of the improvements lately effected in marine engines, the machinery of the *Iris* weighed 1,100 tons and developed about 7,500 I.H.P. These engines were thought at the time to be a marvel of lightness and efficiency, but in some of the contracts lately placed by the Admiralty 10,500 I.H.P. has been guaranteed for engines of less weight. On the present scale of construction, therefore, the engines of the weight of those supplied to the *Iris* ought to develop 11,000 H.P.

We see that a very useful contribution on the comparative value of iron and steel in shipbuilding has been given by Mr. J. H. Biles, of Messrs. Thompson's Clyde Bank ship and engine works, before the Iron and Steel Institute. Mr. Biles undertook to show that, on the Clyde, construction in steel had now reached a point where, for a given size, the cost of iron and steel had become equal, with an increased carrying capacity in favour of steel. He was able, however, to define very closely the exact practical saving in weight that could actually be effected in vessels of various tonnage. Although this is theoretically about 17 per cent., after allowing for difference of specific gravity, it was practically reduced to an average of about 13·6 per cent. throughout. It is found also that the larger size plates for given thickness which can be produced in steel, effect a great saving in labour and material in laps and butt straps, and in riveting. As to the objections raised against steel, that of brittleness has long ceased to carry any weight, as it is universally acknowledged that the mild steel used is of greater ductility than iron, and it is now feared in some quarters that the ductility of the material will render the ship less rigid. The next great difficulty which Mr. Biles treated was that of corrosion, which he considered could be entirely obviated by sufficient care and protection. The Admiralty having discovered that most of the corrosion was due to galvanic action between the black oxide or scale and the metal itself, treated all their plating to a dilute acid bath to remove the scale. Messrs. Thompson have devised a fast running wire brush machine which, after the acid bath, burnishes the surface of the plate at a cost not exceeding 1s. per ton on the weight of the ship. Galvanising is suggested as a remedy for those plates most liable to corrode, and if it could be successfully and generally applied without deterioration to the metal, it ought to be a valuable process as applied to the same.

LIQUID FUEL.

(*Concluded from page* 160.)

THE highest evaporative value obtained from oil does not necessarily result in a reduced fuel bill. We are given to understand that oil purchased in experimental quantities is 65s. per ton, but that it can be manufactured for as little as 30s. per ton. Even this latter amount is about twice that of ordinary coal, and completely wipes out the money gain from the use of oil. It is to be feared too, that as soon as the practice became general and the demand for oil increased, that the price would rise considerably; quoting Admiral Selwyn's language, "a diamond-seeker would not sell his stones for pebbles as soon as he knew them to be diamonds." We observe too that the experimenter purchased his oil for 13s. 9d. per ton in 1868, which clearly indicates a sensitive tendency to rise in price. We do not say that oil would not be an economical fuel under every circumstance, we only hold that opinion supposing its use to become general; in works that produced oil as a bye product and with no higher future before it than to be thrown away as waste it would obviously be a clear gain to the owners if they could employ it in the furnaces of their boilers. There are also circumstances where its advantages of easy control and cleanliness would make it desirable.

The great objection to the use of this substance on steam vessels is not so much that it would not pay, but that it would introduce a greater probability of starting a fire, and that when once it had become ignited it would be almost impossible to put it

out. Every oil, even the most dense, will, if subjected to warmth and stowed in a close atmosphere, give off gases of a combustible character; these gases in existence, and a light brought into their neighbourhood, ignition will take place. The temperature at which oil becomes dangerous is given at the low figure of 240° F., while it may be rendered so at 140° F., if it be soaked into cotton waste or other porous substances. This temperature is easily reached by an ordinary lamp and even by the close neighbourhood of the boilers, and once in a blaze it is more than likely a general conflagration will ensue. On a steamship the oil must necessarily be stowed in out of the way and close chambers; in localities dark and confined, which are difficult to examine and keep thoroughly ventilated, and where such deposits as cotton waste, oakum and other refuse are likely to collect and become soaked with oil leaking from the tanks, tend even to spontaneous combustion. On a man-of-war the evil would be aggravated, for during an action the circumstances are naturally in favour of a fire; red hot shot, rockets and other vicious objects coming over from the enemy, high temperature from the boilers and machinery, bad ventilation, and the fire from the guns on board ones own ship would be sure to find out any weak spot in the combustible. A ship carrying such large quantities as would be necessary could hardly escape certain destruction if a fire started under such circumstances. Such a contingency as this would not be fully met by employing an oil of a specific gravity, greater than that of sea water, and proposing to run it out into the sea when it became dangerous. Supposing it desired to discharge the oil overboard, and communication established between the oil inboard and the sea, the only result would be that the oil would descend to a short distance below the water level and there remain stationary. As soon as the weight of the columns of oil inboard became equal to the weight of the opposing column of water outside, all exit would stop; the specific gravity of the oil being 1·060, and that of sea water being 1·028, the flow would cease in a vessel drawing 21¼ ft. of water, when the height of the oil was 20¼ ft. If the natural proposal be carried out that the oil be stowed as low down as possible, very little, if any, could be got rid of in that way.

The great advantage of using liquid fuel is that the combustion is under such perfect and easy control, and that the sooting-up of the furnaces and tubes is almost altogether avoided. These advantages are, it must be confessed, extremely tempting; human endurance would no longer be pushed to its extreme limit in keeping furnaces raging for full speed in hot climates; steam for full power or steam for little power could be obtained at once by the turning of a few taps; and the boilers remaining comparatively clean would keep at their best efficiency for weeks together. In many cases liquid fuel is already in use, and have shown that these advantages really exist; but it is quite evident that it is only used where oil is very cheap and where there is no especial danger from its stowage. In many manufactories about the country where oil is a bye product it is so utilised; Russian steamers on the Caspian, where oil is obtained in abundance, and where the journeys are so short that the stowage is not very great, use it with success. And we should think that there are other circumstances where it might be employed with a good result. Harbour pinnaces and launches, and even torpedo boats, could be so equipped. An objection might be raised that there are dangers enough already besetting a topedo boat without adding to their number; but it would be worth some extra risk in order to give such a craft the power of running at her full speed for a long period. As matters at present stand, the boiler tubes of high-speed boats so soon become clogged with soot and ashes, that it is difficult to run them for many hours at their highest rate. It is also doubtful whether the use of oil as a fuel would add much to the danger of the boat. Under ordinary circumstances the tanks would be easily accessible, might be well ventilated, and never being far from larger vessels a fire on board would not have a very severe effect. During an attack by the boat there would hardly be sufficient time to apprehend any danger from this source. The employment of liquid fuel in this case might result in rendering unnecessary a very unpleasant billet. With the furnace under such easy management the stoker might be dispensed with, and the whole of the operations connected with the boiler freely regulated from the engine room.

Our opinion is that the value of liquid fuel ought to be properly tested, and applied in those cases where it is found to be suitable, and we are therefore glad to notice that experiments are being made in various quarters. The *Times* publishes the news that the Admiralty are alive to the question, and have directed experiments to be carried out on a small boat at Portsmouth.

Many readers of THE MARINE ENGINEER may probably have had some experience with the use of oil as a fuel, and as it is one of the objects of this journal to collect all such information and bring it to a focus, any facts bearing upon this subject would be welcomed.

MERCHANT SHIPS AS WAR AUXILIARIES.

(*Concluded from page 158*).

ABOUT ten years ago a system was adopted by the Constructive Department of the Admiralty to inspect, while building, and upon trial trips, all the better class of British merchant steamers, and those that were found suitable to become war auxiliaries, either as cruisers or transports, were to be entered in a register called the Admiralty List. To entitle them to this distinction, it was stipulated that they should be divided by watertight bulkheads, so that they could float with any one compartment open to the sea, but these divisions, and the height to which the bulkheads are carried, would, if even two compartments were broken into, result in no serious injury to the ships. All the leading British steamship companies, except two, appear to have willingly acceded to these constructive requirements, and nearly four hundred steamers have been entered in the Admiralty List. Their speed ranges from 12 to 18½ knots per hour. About fifty of them, having a speed of 14 knots an hour and upwards, can carry sufficient coal to steam round the world at 12½ knots, while the fastest, as the *Umbria*, *Etruria*, and *Oregon*, of the Cunard line, the *America*, of the National line, the *Alaska*, of the Guion line, the *City of Rome*, of the Anchor line, the *Austral*, of the Orient line, the *Britannic* and *Germanic*, of the White Star line, and the *Nord America*, recently purchased by the Government from an Italian firm, can carry enough coal to steam at full speed for nearly a fortnight.

Now, considering that the coal endurance of cruisers is nearly as important as speed, and that several men-of-war of this class belonging to foreign Powers have a better fuel-carrying capacity in proportion to their displacement than any cruiser of the British navy except the *Impérieuse* and *Warspite*, it is astonishing, and much to be regretted that the five belted cruisers of an improved *Mersey* type to be built for our navy are only to have a coal supply sufficient to propel them for 2,000 knots at full speed without recoaling. There can be no doubt that one of the most grievous defects of our first and second class unarmoured cruisers is that none of them can steam for five days at full speed; though the higher speeds at which they can be driven is considerably less than that of many British and foreign merchant steamers. This defect has been pointed out repeatedly, but to no purpose. It is no answer by the apologists of these war ships, that the *Esmeralda*, built for the Chilian, and the *Giovanni Bausan*, constructed for the Italian navy, which are said to be the best type of "protected cruisers" in the world, have also very small coal-carrying capacity in proportion to their dimensions. These facts are calculated to materially enhance the importance and increase the use of our swiftest merchantmen as armed cruisers and transports.

The number of rapid foreign merchant steamers capable of being propelled at 15 knots an hour or more is not as numerous as British ships of such a speed, while none can steam as swiftly as the quickest six of our ocean liners. The fastest foreign merchantmen are five of the North German Lloyd's line, running between Bremen and New York; two of the General Transatlantic Company, running between Havre and New York; and three of the Mexican Transatlantic Company, steaming between European ports and Vera Cruz. The Australian liners of the Messageries Maritimes Company, and the North American and Indian liners of the General Italian Navigation Company, and one belonging to the Pacific Coast Steamship Company, appear to be the only other ships which can justly be classed among the fastest steamers off the British register, all of which are 15 knot ships or thereabouts. It should be mentioned, however, that four steamers of 17 knots speed are being constructed for the General Transatlantic Company, which will rank with the five principal North German Lloyd's liners for making rapid voyages. We have stated these facts about the quickest foreign steamships in order to give our readers a better idea of the number of rapid merchantmen which may be engaged against us in warfare.

Although the ships on the Admiralty list cannot be armoured except by chains suspended from their sides, and which could be utilised as torpedo netting, by being lowered for this purpose,

some appreciable protection may be given to the engines and boilers, technically called "the vitals," and other parts, by systematically placing coals in sacks, as was done in fitting up the *America* and *Oregon* as armed cruisers, during the impending war with Russia; and this plan is also recommended to be adopted for the better safety of the "protected cruiser" *Esmeralda*, recently built by Armstrong & Co., for the Chilian Government.

The vessels of the mercantile marine to be used as cruisers should also be armed with the most efficient breechloaders, and an adequate supply of machine and quick-firing guns and revolving cannons. They should also be provided with proper torpedo boats and the best torpedoes, such boats to be efficiently armed with rapid-firing guns and revolving cannons, and manned by trained men in torpedo exercise, as the enemy's naval and improvised cruisers to be encountered will probably be supplied with these several kinds of armament.

Now although no such armed merchant cruiser or armed transport could be matched to cope with a specially built armoured war cruiser with thick plating from stem to stern, if similarly armed, two or more of these naval auxiliaries might be able to destroy the latter if cruising or traversing the sea within signalling distance; and they would, with little doubt, be able to sink her, if she was not mounted with long-ranged breechloaders, and was without torpedo boats. Another advantage of rapid merchant ships as cruisers is that, if they are much quicker than the regular war cruisers of the enemy, they can evade the latter, and warn other merchantmen, within a certain area, of the possibility of their being pursued by the naval cruiser, and therefore in some cases cause them to escape capture and destruction by making to some near port or harbour of safety. If improvised armed cruisers or armed transports were not efficiently armed, they could not safely fight the cruisers of this class of the enemy, though of much less speed, if well armed either with long-ranged breechloaders or first-class torpedo boats. Under such circumstances, then, British merchant ships would have to retreat as from regular armoured war cruisers.

If we were at war with a leading naval Power or formidable maritime allied Powers, there are other important services which our merchant ships should perform in addition to those of armed cruisers and armed transports for the conveyance of troops, horses, ammunition, and other war stores. A great number of them would be necessary to carry coals to our foreign coaling stations, which, but for the supply, would soon be exhausted. Many of them might sail together under convoy of naval crusiers, and improved armoured torpedo rams of the modified *Scout* type, being required reformed quasi-gunboats. Quicker colliers would be necessary to supply our ironclads from these foreign coaling stations, if the latter were blockading ports or otherwise engaged at a long distance from these stations. It might also be desirable or necessary to use another class of merchant cargo steamers as floating coal depots, to accompany the ironclads in action. Several rapid merchant steamers would also be required as despatch boats, and for the supply of additional stores and provisions for the navy and troops, and as scouts or look-out vessels for ironclads. A further class would be necessary for hospital ships, and some to tow disabled ironclads and other fighting ships into port. These merchantmen should be manned by their usual engineers and stokers, but for other purposes mostly by men of the Royal Naval Reserve.

Moreover, as our home coasts and their harbours are unprotected by torpedo boats, and are not likely to be adequately provided with them for several years, on account of the immense number of boats necessary for this purpose, it is very probable that a raid would be attempted on the coast towns by an enemy's squadron accompanied by torpedo boats. The Admiralty should, therefore, engage a sufficient number of the fastest small steamers of our mercantile marine for coastwise cruising, each of which should patrol about ten or fifteen miles of coast line. The number of Coastguard ships and their small tenders are far too small in number and efficiency to be used for this service. The small steamers to be hired should be armed with the best rapid firing guns, a set of revolving cannons, and two small long range breechloaders, and carry at least two fish torpedoes with ready means for launching them. These vessels should also be navigated by men who have been accustomed to the command of coastwise steamers, and who therefore know the dangerous parts of the coast, as all lights in war time would be extinguished, and the buoys removed. Upon discovering a hostile ship or ships or torpedo boats, they should at once communicate this event to the nearest torpedo station, whereby offensive and defensive operations might be commenced as quickly as possible, either by the use of coast or harbour torpedo boats, ironclads or other warships. The armament of these coastwise merchantmen would be mostly required for their own defence and but seldom for attack. We believe that the Admiralty have a list of these ships of about a thousand tons displacement and under, and which may be available as coastwise cruisers. So defective is the speed of our gunboats that but exceedingly few are suitable for this service, nor could efficient ones be spared for this duty.

So great is our deficiency in naval guns and torpedo boats, that our merchantmen could not render the Navy more than half the service they otherwise could as cruisers. It is to be hoped that this great disadvantage will soon be remedied. Lastly, it is essential to know that even if our Home, Indian, and Colonial coasts and ports are fully defended by torpedo boats, ironclads, gunboats, and fortifications, the utilization of a great number of our merchant steamers would even then be urgently required if we were at war with a leading naval Power, both to protect our sea-borne commerce and coal supplies, and troops and stores and despatches to foreign stations. It will, however, be impossible in this event for us to engage from the British mercantile marine alone a sufficient number of as fast steamers as will answer our requirements, as many of these will be necessary to carry mails and passengers and import provisions. Nor will this deficiency be likely to be supplied by hiring foreign merchantmen of great speed, for, as we have before mentioned, these are few, and some of them would be engaged by the enemy. It is essential, therefore, that as we cannot expect to have ready for sea anything like a sufficient number of naval cruisers for our protection, there should be a great addition to the number of ordered modified *Scouts* or torpedo rams, to displace a vast number of our almost useless gun vessels and gunboats.

From the foregoing observations it is evident that the mercantile marine of Great Britain has not only been the main cause of her wealth and leading status among nations, but that it is capable of being eminently useful in offensive and defensive maritime warfare.

It is to be hoped that no time will be lost in completing a sufficiency of the best long range breechloaders for the use of our merchantmen, as well as proper torpedo armaments. The lack of these, during the recently expected war with Russia, was much dreaded by all naval officers, as it was thought they would not be able to contend against even the third class naval cruisers of the enemy.

THE WHITE STAR LINE.

PRESENTATIONS TO MESSRS. ISMAY AND IMRIE.

SOME years ago an offer was made to increase the remuneration of Messrs. Ismay & Imrie, the managing owners of the White Star Line of steamers, which are identified with the Oceanic Steam Navigation Company. The kind offer of the shareholders was declined, and it was then resolved to present them with a handsome testimonial. Though some years have since elapsed, and serious depression has passed over the mercantile marine, the White Star Company have well held their own. A grand banquet was served in the saloon of the *Adriatic* on the night of Sept. 16, which left the Mersey next day for New York. About 100 guests were present, amongst them being Mr. T. H. Jackson (Messrs. G. H. Fletcher & Co.), who occupied the chair, Mr. and Mrs. Ismay, Mr. and Mrs. Imrie, Mr. and Mrs. W. S. Graves, Sir E. J. Hartland, Bart., Mr. Wolff, Mrs. and the Misses T. H. Jackson, Mr. and Mrs. Barrow, Mr. and Mrs. Haddock, Mr. and Mrs. Sealby, Mr. and Mrs. Pirrie, &c. After the dinner, and before proceeding with the presentation, letters were read from shareholders who were prevented from being present.

The presentation to Mr. Ismay consisted of a valuable service of plate, designed and manufactured by Messrs. Hunt & Roskell, of London, and his portrait by Sir J. E. Millais, R.A.; and to Mr. Imrie, of two pictures selected by himself, one entitled "Melitton," by Sir Frederick Leighton, F.R.A., and the other "The Feast of Pomona," by L. Alma-Tadema, R.A. The service of plate presented to Mr. Ismay is in silver-gilt, and consists of a centre piece, four candelabra, two oval flower stands, four round and two oval fruit stands, two sugar vases and ladles, two claret or water jugs, four goblets, and 12 salt cellars and spoons. The various pieces have been designed to illustrate the progress of the art of navigation from the earliest times to the present day, its means and objects. The centre piece is a magnificent illustra-

tion of the art of modelling in silver, the designer and modeller being Mr. G. A. Carter. On this piece, and occupying the central position of the whole service, is a globe with the seas and continents marked upon it. Round it are seated figures of four of the chief navigators associated with discovery. Jason, as leader of the earliest recorded expedition across the seas; Vasco de Gama, the discoverer of the route to India by doubling the Cape; Columbus; and Captain Cook. The base is ornamented with four small groups symbolical of the winds and of the sea and its attributes. At the angles of the plinth supporting the globe are four small groups, typical of the four continents. The lower moulding of this and of all the other pieces in the service is enriched with the Greek wave, a symbol of the sea, the base from which the subject —Navigation—springs. Other mouldings are formed of shells, cable, &c. Upon two of the four panels behind the figures of the great navigators are engraved the official seal of the Oceanic Steam Navigation Company and Mr. Ismay's crest, and upon the other two appear the following inscription:—"The service of plate, of which this is the centre, is presented to Thomas Henry Ismay, Esq., by the shareholders of the White Star Line in token of the esteem in which he is held by them, and in recognition of the fact that to the sound judgment, untiring energy, and singleness of purpose he has displayed in the management of their affairs for the past 15 years, the prosperity of the company is mainly due."

Mr. T. H. Jackson made the presentations, and remarked that naturally some of them would ask how it was that so long a time had elapsed between the appointment of the presentation committee and the completion of their duty; but they would see that such a design as that before them in the service of plate could not be obtained in a day. At any rate, they were now met to celebrate the completion of this most pleasant and agreeable task, and to ask the managers to accept these acknowledgments of their great indebtedness to them. He need not refer to the satisfactory position the company had attained, because all the shareholders were as well aware of it as he was, and it only remained for him to congratulate the shareholders and the managers upon the company's continued prosperity.

Mr. Ismay gracefully acknowledged the compliment which had been paid him, and remarked that the service of plate would remind him, not only of their kindness, but of the claims of a trade which had contributed so largely to promote the general prosperity of this country. When, in addition to these considerations, he recalled the fact that this handsome gift was an expression of their satisfaction with his efforts, and the efforts of his firm, to serve them, it became more difficult for him to express what he felt. More than 16 years ago they entrusted him, and those who were associated with him, with very full powers—making them rather working and confidential partners than managers—and the pleasant gathering that afternoon was a sign and token most gratifying to himself and partners that their confidence had not been misplaced.

Mr. Imrie, in responding, remarked that the pictures would ever remind him of the very happy associations that had invariably surrounded their managers in the discharge of their duties in connection with a business fraught with so many cares and anxieties; and if any effort on his part had been of assistance to his partner he was more than satisfied; and as long as he lived he should look back with pleasure upon that happy gathering on board of the *Adriatic*.

Mr. Ismay then proposed, in a highly eulogistic speech, the toast of "The Builders," Messrs. Harland & Wolff, and he observed that when they engaged the firm to build the White Star ships they made no hard and fast contract with them. They simply said, "Give us the benefit of your experience and skill, and do your best to build steamers fitted for the most trying and exacting trade in the world." The result was that they had not only served them, but had served the interests of commerce all over the world.

Sir Edward Harland, in a speech tracing the successful career of the White Star Company, acknowledged their compliment. He commended the style of the ship of which the *Adriatic* was a pattern, and predicted that ere long the "greyhounds" of the Atlantic, from a commercial point of view, would be proved to be an egregious mistake.

Other toasts and the health of the chairman having been drunk with enthusiasm, the company returned to the landing stage.

There can be no doubt that the Oceanic Steam Navigation Company, better known as the White Star Line, is one of the leading steamship concerns in the world, and is second to none in its class of steamers and the excellent manner in which it is managed. The main line of the ships of this company run between Liverpool and New York. They have also three steamers trading between London and New Zealand, on the Shaw, Savill, and Albion Co.'s Line, and two between San Francisco and Japan. The steamers of the Oceanic Company have been built by Messrs. Harland and Wolff, of Belfast. These are so well constructed, both for speed, passenger accommodation, cargo, and economisation of fuel, that they are the best type for the purposes for which they are intended, and other builders have adopted the type, though some of them have not had the grace to acknowledge it. To Messrs. Harland and Wolff the credit is due for having constructed a class of steamers which before the *Oceanic* was previously unknown, and which type has subsequently been accepted as the highest standard of ocean-going steamers.

For several years during which the White Star Liners have carried the transatlantic mails, their steamers have run quicker and kept more uniform time than the ships of any other line, if fleet be compared with fleet. In January, 1873, the *Baltic* crossed from New York to Queenstown in 7 days, 20 hours, and 9 minutes, while last October the *Britannic*, which was then nearly twelve years old, and with her original boilers in use, made the passage from New York to Queenstown in 7 days and 11 hours on a consumption of 100 tons of coal per day.

The following are amongst the most remarkable passages of each steamer of the transatlantic line of the Oceanic Steam Navigation Company from 1877 to 1884 inclusive:—

QUEENSTOWN TO NEW YORK.

			Days.	H.	M.
Germanic	April,	1877	7	11	37
Britannic	Aug.,	1877	7	10	53
Celtic	July,	1879	8	4	25
Baltic	Sept.,	1879	8	0	6
Republic	Sept.,	1881	8	1	20
Britannic	Aug.,	1883	7	13	39
Britannic	Aug.,	1884	7	17	22
Adriatic	Aug.,	1884	8	1	22

NEW YORK TO QUEENSTOWN.

Germanic	Feb.,	1876	7	15	17
Britannic	Dec.,	1876	7	12	41
Celtic	June,	1879	8	0	0
Baltic	Dec.,	1880	8	1	13
Republic	June,	1881	8	4	34
Britannic	June,	1883	7	17	0
Britannic	Oct.,	1884	7	42	17
Adriatic	Nov.,	1884	7	20	43

These steamers owe some of their high speed to the unusally great sail power with which they are provided, and this advantage also steadies them and renders them more comfortable for passengers in bad weather. If their shafting is broken they are converted into large first-class sailing vessels, and can make their way to their destination in an appreciable manner.

The *Arabic*, which is run on the Pacific, has made the passage between San Francisco and Yokohama in 13 days and 21 hours, and the *Oceanic* in 14 days and 5 hours. The *Doric* has also run from New Zealand to Plymouth in 37 days and 11 hours, which at the time it was made was the quickest passage.

Many adverse comments have been made by the managers and engineers of leading lines of passenger steamers respecting the assertion of Mr. Pearce, of Messrs. John Elder & Co., that steamers driven at very high speed with passengers, and with but little or no cargo, will be the most profitable. It is quite clear that the weight of testimony is against this allegation, as passengers will not pay the large extra rate which would have to be charged in order to make such ships remunerative, on account of the prodigious extra quantity of coals required to be consumed to drive steamers at speeds exceeding 17 knots. The quantity of coals consumed by the *Oregon* and *Etruria* in making their quickest runs between Queenstown and New York was about 300 tons a day, as against about 80 and 100 tons burnt in the steamers of the White Star Line, which make the passages in less than an additional day's time. It is said that but for the accident of the *Oregon* and *Etruria* being engaged by the Government during the recently expected war with Russia, it is possible that the shareholders of the Cunard Line would have realised the fact that if these steamers had been continuously driven at the highest rates, they would not have been remunerative.

The managers of the White Star Line are fully alive to the importance of adopting the latest improvements in passenger steamers, but they have to study the interests of the shareholders and to satisfy them that such improvements are for their interests, and these objects they have accomplished satisfactorily.

REPAIRING AND REFITTING IN THE ROYAL NAVY.

THE Lords of the Admiralty have issued some important new instructions with reference to the repair and refit of Her Majesty's ships. The existing regulations enforcing the annual survey of ships in the dockyards are cancelled, and triennial surveys substituted. A number of new clauses are added, to the following effect:—On a ship receiving orders to return to England to pay off, the commanding officer is to prepare, on the way home, full and detailed statements of all defects known to exist in the ship, as well as of all alterations or additions he may have to suggest; and these lists are to be sent in on her arrival at the port. Commanding officers are to take care that the items contain specific information as to the nature of the defects, and that defects are not inserted in such general terms as "masts and yards require overhaul," "boats require repair," &c., a practice which entails on the dockyard officers the necessity of making an examination for the details of defects. As soon as possible after the ship's arrival, and before she comes into harbour to be paid off, a full-power steam trial of at least one hour should be made, if practicable. The usual dockyard and Steam Reserve officers will attend to watch the trial, and are to be previously furnished, if possible, with the lists of defects. Notice of the trial is to be given to the Admiralty. The following work is to be done by the crew before the ship is paid off:—(*a*) Lower yards and topmasts are to be struck and the topsail yards sent down for examination by the dockyard officer. If found in good condition they are to be refitted and sent up again, and any found defective are to be landed. This work is to be done by the ship's crew. (*b*) The topgallant masts and yards and rigging are to be landed for examination, and, if found to be serviceable, they are to be replaced by the ship's crew, if possible, before paying off. (*c*) The sails and running rigging are to be landed for survey. (*d*) The boats are to be landed for repair. (*e*) The chain cables are to be landed for testing. (*f*) All furniture of mess-places and cabins is to be landed for renovation, except such as may be fixed in the ship, in order that the cabins, &c., may be thoroughly cleaned and painted. (*g*) As a ship arriving home from a foreign station will generally have left behind her all stores that are serviceable, except those required for the passage home, it is desirable that the condition of such stores as remain in the ship should be ascertained, and for this purpose all stores are to be returned, except those made for, or specially adapted to, that particular ship, or which form part of her fixtures. The stores that remain on board are to be charged by the storekeeper to the Captain of the Reserve, and the warrant officers' and engineers' store account are to be closed. (*h*) All coal is to be removed from the ship. (*i*) The tanks will be examined in place by the dockyard officers, if practicable, and if found to be in good condition should remain on board, unless required to be removed for the examination of the hull. (*j*) The guns will be examined by the War Department, and the carriages by the War Department or the dockyard officers, as the case may be, and, if not required to be removed for repairs, they are to remain on board. The machine guns and small arms are to be returned to the Gun-wharf. (*k*) The machinery is to be opened up for inspection as laid down in the Steam Reserve instructions. A navigating officer, a chief engineer, and warrant officers will be appointed to the guardship of Reserve for the ship before she pays off, in order that they may make themselves acquainted with her condition and be ready to take charge of the stores which remain in her. When ships in commission come into the dockyard to have defects made good, only such defects as have been represented by the officers of the ship, or have been apparent to the examining officers, and which may be approved to be taken in hand, will be made good. No special examination will be made in search of further defects. The examination of the hulls of ships in commission by the dockyard officers, which has hitherto been held annually, will in future take place only once in three years, the annual and quarterly examination by the officers of the ship being considered sufficient in the intervals.

PREPARATIONS were being made, at the time of our going to press, at Chatham Dockyard for the launch of the steel cruiser *Severn*, 12, 3,550 tons, 6,000 H.P., which will take place immediately. The vessel, which has a length of 300 ft., is one of the longest unarmoured ships ever constructed at Chatham.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The shipbuilding trade of the Tyne is scarcely so good at the end of September as it was at the same time last month. The vessels that have been launched have not in every case been replaced by others, and the work on the stocks has generally been so far advanced as to enable managers to dispense with the services of hands in different departments. An important incident in connection with the Tyne shipbuilding trade is the purchase by the Spanish Government of two cruisers, originally ordered from Sir William Armstrong, Mitchell & Co. by the Japanese Government. The meaning of this transfer of proprietorship in the cruisers, will probably be that two others will be laid down for the Government of the more distant country. The composite gunboats *Rattler* and *Wasp*, which have been ordered by the Admiralty, have been laid down at the Elswick yard, and these, with the other work in progress, are making the place busy. The company are, it is stated, about to make a large graving dock at their Low Walker yard. They are at present dependent upon other firms for the accommodation required when ships' bottoms have to be inspected or repaired, and it now appears that they have determined to provide the accommodation for themselves. The eminent Tyne shipbuilder, Mr. Andrew Leslie, has, after a connection with the establishment of thirty-seven years, retired from the direction and proprietorship of the shipbuilding yard at Hebburn known as Messrs. A. Leslie & Co.'s. Mr. Arthur Coote, the son-in-law of Mr. Leslie, will now be the sole owner of the establishment, and it is understood that he is about to amalgamate with a firm of Tyneside engineers, the whole to form one great shipbuilding and engineering establishment. Messrs. Richardson's and Messrs. Swan & Hunter's yards, which were lately showing a fair state of activity, are now to be numbered among the very slack establishments, there being scarcely anything to do in either of the yards. Messrs. Palmer have very little work in hand besides the Government cruisers, but there is so much work about these that the establishment at Jarrow is kept pretty well up to its ordinary standard of briskness. The Tyne Shipbuilding Company have commenced the construction of a large vessel; but at Messrs. Edwards's yard all contracts have been finished up, and the yard is practically at a standstill. Frame-turning is again proceeding at Messrs. Readhead's yard, and in a short time there will be work for the outside hands. Marine engine works are still exceedingly slack, but bridge yards at Gateshead and Elswick are having plenty of work. Messrs. Hawks, Crayshaw & Sons, of Gateshead, are making the second span of a large railway bridge for India, and among the contracts in hand at Sir William Armstrong, Mitchell and Co.'s bridge yard, Elswick, are fifty cranes of a special type for the Italian Government, and two large dock gates for Cardiff. The work in this, as well as in the engine and ordnance shops, was stopped for a fortnight in consequence of the strike, which closed on September 16th, and efforts are now being made to make up for lost time by overtime and nightwork. Foundries on the Tyne are doing very little, with the exception of Messrs. Abbott's metal pipe foundry, at Gateshead. This firm have lately erected new premises and laid down new plant in this department of their works, and they are now reaping the fruit of their enterprise in getting plenty of orders. Ironworks at Gateshead and Jarrow are only working intermittently, and most of the forges are standing idle.

The Wear.—No orders have been recently booked by Wear shipbuilders, and as there is only a small amount of work in hand, the outlook for the approaching winter is exceedingly bad. Messrs. J. L. Thompson & Son's yard is certainly still very busy, there being not only a full occupation of the building berths, but a guarantee of other work to be laid down, in the shape of large deliveries of steel frames, &c., for vessels whose numbers have not yet appeared on the stocks. This is the only establishment on the Wear, however, which shows any approach to briskness, all the rest being either closed or only working on a limited scale. Messrs. Blumer & Robson are about to build a vessel on "spec," after having had their machinery standing for nearly a year, and Messrs. Short Brothers have commenced the construction of a vessel on the same principle. The Sunderland Shipbuilding Company's yard takes second place so far as regards the state of business, there being a fair share of both new and old work in hand. The shell platers at Mr. Laing's yard, Deptford, stopped work on Sept. 17th, owing to an intimation from the Firm that the price of plating work would be reduced 7½ per cent. At the

time of writing no settlement had been arrived at, and the work was still standing. The only work at present to be seen in the yard is the vessel which was being plated, and one which is in the course of framing. Messrs. Osborne & Graham have just launched a large caisson for the Wear Commissioners, and they have two steamers on the stocks in the plating and framing stages. The small yard of Messrs. Knox & Co., which was closed for several months, has been re-opened, and the finishing work of two steamers is being proceeded with. In the marine engineering business great dulness still prevails, some of the principal establishments having only a little repairing work in hand. Messrs. Clark and Messrs. Carr & Co. have, however, some work in their boiler departments, and have recently taken on some hands. Foundries are doing scarcely anything, and out of seven forges on the river only two are in operation. It is understood, however, that a third establishment is about to start, as the furnaces are being repaired. The Fulwell Rolling Mills have only been turning out small iron, the product of the Guide mill for some time past, but an order for beams and other heavy work has lately caused the larger mill to be started. The chain and anchor making trades are affected by the depression in shipbuilding, and there is now very little work for the operatives.

Hartlepool and the Tees.—Messrs. Withey have nearly completed the contracts they have had in hand, and as there are no signs of anything to replace them, the future prospect is the reverse of encouraging. At Mr. Gray's yard there is a fair amount of work in progress, but the other Hartlepool yards are very slack. Messrs. Railton Dixon & Co., of Middlesbro', have just obtained an order for two large steamers, and as they had one already on the stocks, there is now a sufficiency of work to keep the place busy over the winter months. Both shipbuilding yards and engineering works at Stockton are very slack, and large numbers of operatives connected with these industries are idle.

FOREIGN v. HOME SHIPBUILDING.

IN our last issue we drew attention to the statements of a member of the firm of Cramp & Sons, of Philadelphia, respecting the cost of shipbuilding in the United States, in which he alleged that not only that firm, but probably any of the large shipbuilding establishments on the Delaware River would agree to build iron ships at a smaller price than they would cost in the yards of the United Kingdom.

Since then Mr. C. M. Palmer, M.P., of Palmer's Shipbuilding and Iron Company, of Jarrow, has been interviewed by one of the writers of the *Daily News*, respecting, among other subjects, the cost of, and time required in, constructing ships in foreign yards, and the published statements of this eminent shipbuilder are particularly interesting, from the fact that he states that this country has little to fear from foreign competition in shipbuilding. His remarks are very forcible when he says "Foreign competition in iron shipbuilding will be a chimera so long as we retain the qualities which have made England great; I mean the energy to get through the work and the determination to excel in speed as well as quality. We have immense natural advantages, and our labour, if dearer, is better, than the best procurable abroad. . . . . Foreigners have not the organisation nor the pace of our people. We can nearly build a ship while they are thinking it over. Their cheap labour means slow work, and their hands are inferior. . . . . Our managers are men of especial talent, and those who may be called our non-commissioned officers are very superior to the corresponding men abroad, who seem to be mere machines, without the initiative of our foremen and gangers, who know their business down to the ground; are handy with suggestions, and full of energy, dash, and go. In comparison with them the foreigner is dreadfully slow and methodical. So slow are they that we can turn out four ships while they turn out one. Now when it is considered that the great feature of modern life is pace, the foreigner cannot live with us. . . . . A man who wants a ship wants it at once or nearly so. He thinks that three years of waiting signify a loss of profit, equivalent to the differences between home and foreign prices. Hence he discards the Frenchman or Dane, and orders his ship where he can get it much quicker. The foreign workman is so slow that customers rescind their contracts." Speaking of American shipbuilding, we agree with him that on account of excessive wages and high rates, supported by a high tariff, the prices of the United States shipbuilders are false prices, therefore we have nothing to dread in competition from the work of the American yards. The Germans, Swedes, and Danes are said to be pretty good shipbuilders, as their raw material is close to them; but they have no large establishments for constructing ships and would neither obtain any large contract, nor execute it within a reasonable time. Their labour is also said to be exceedingly bad. Upon the French shipbuilding Mr. Palmer has made some very caustic remarks, for he says, after observing that the French bounty system has completely failed with regard to shipbuilding, that "French shipbuilders apparently exist for the purpose of showing that there can be something slower than our English Government dockyards. There is no fear from France when things are done in a penny wise spirit. It is like the Irish peasant who drives his pig twenty miles to market and back again because he cannot get within five shillings of his price. If the man were good for anything his day's work would be worth five shillings. It is the old story—cheap and bad." The fact of the North-German Lloyd's Company, the General Italian Navigation Company, and other foreign steamship companies having had their leading ocean liners built in British yards, is important evidence that they are better satisfied with our shipbuilding. In short, it may justly be stated that this country will always maintain her proud position of being by far the greatest shipbuilders as well as the greatest repairers of ships in the world.

NORTHERN SHIPBUILDING.

SHIPBUILDING in the north is one of the controlling industries; it affects the steel and plate manufactures, and thus the iron trade as a whole; while the coal trade benefits greatly by its briskness, and the whole of the labour markets share therein. For considerably more than a year there has been growing dulness, and it settled ultimately into a depression so keen as to affect the whole of the shipbuilding ports last winter, and to threaten them in the coming one. It will be needful in considering the cause to name briefly that of the uprisal of the trade on the north-east coast. There had been comparatively large wooden shipbuilding industries at some of these ports anterior to the iron era, especially at Sunderland and on the Tyne, and there were thus the artisans who concentrated the experience of generations of shipwrights. It was easy to add the iron branch of the trade, which ultimately supplanted the older; and as there were the great desiderata of cheap iron and contiguous and abundant coal, the newer industry grew with the comparatively slight fluctuation which the changes of trade enforced. But the steam iron cargo-carrying fleet proved profitable, and comparatively new developments of the marine engine enabled it to do increased work at less cost. Thus for years it attracted capital, on which an abnormally high rate of interest was paid; and thus fostered steam shipping grew at all the ports of the north-eastern district. Shipbuilding shared in that prosperity, and the number of shipyards, of building berths, and of workmen therein, increased. The maximum was reached about the end of the year 1883, when there was perhaps the largest tonnage in course of construction that had been registered. The declension last year was great, especially during the later months of the year. In 1884, the ports of the Tyne, Wear, West Hartlepool, and the Tees, with the smaller ports of Blyth and Whitby, built 297,000 tons of iron vessels, which was rather less than one-half of the total of the previous year, when the maximum tonnage was launched. Each of the ports felt the depression, and over the present year it has been experienced. But more than that declension in the total tonnage was known. Vessels that had been sold, were, in consequence of the state of the freight market, thrown upon the hands of the builders, and some had to be realised at any cost. The strain was possibly the keenest at the beginning of the present year, and it was intensified by the lessened exportation and importation of commodities, and the consequential collapse in the freight market. During the present year there has been a continuance of restriction of building, and it is probably a safe estimate to say that in this month not one-half of the building berths at the shipyards in the northern ports are employed. Orders, indeed, came into the market at the beginning of the year, but it was because of the very low price quoted for new vessels, and because some owners deemed it fitting to renew their fleets when they could take advantage of prices lower than had ruled for years. These are being worked off, and not in all

cases are they now being replaced. On the Tyne, however, Government work will fill some of the gaps, and at the other ports the building of vessels for special use is giving a little work. But partial employment only for the yards is probable for some time to come, and the freight market will, in the end, feel the relief which lessened building and continuous loss give. During nearly every month of the current year the tonnage of vessels launched has shown a decrease from that of the corresponding month of the past year—that decrease being from 9,000 to 20,000 tons monthly for the whole of the shipbuilding ports.

Already this year the output of tonnage from the Clyde alone is less by 144,000 tons than it was in the same period of 1883; and the relative falling off at the other chief ports is equally marked. Another change has taken place, too, in the quality of the tonnage launched—the steamships built show a very much greater reduction than that indicated, while the sailing vessels have, in several recent months, shown an increase over these for corresponding months of last year. Thus, while in the first quarter of this year the steamships launched at the chief ports were about 55,000 tons as against 114,000 tons in the corresponding quarter of last year, the sailing vessels launched increased from 18,000 tons for the first quarter of last year to 39,000 tons. The non-replacement of steamships which are lost and the building of a larger quantity of sailing vessels than usual, in consequence of the low price alike of the material and of the labour, are changing the form of a part of our mercantile navy, and enabling that part to do the lesser amount of work which sailing vessels do than do steamships, and thus the contraction of the building will be aided in its effect on the freight market by the change.

At present there is a portion of the carrying fleet laid idle in northern and other waters; but that portion is chiefly of small and often of old steamers which do not work to profit against the newer type, and which necessarily feel most the reduction in the range of freights—a reduction as great as 50, and even a higher percentage. During the coming winter the shipbuilding industry will scarcely produce as much tonnage as it is now doing, and the freight market should feel the benefit of the combination of building less than is the loss of steamships, of the conversion of steamships into sailing vessels, and of any recovery in the export and import trades. But it will be still longer before there is any reflection of that benefit on northern shipbuilding, though the undoubted improvement in the iron trade and in the price of iron must react upon the prices of iron and steel vessels. Thus the winter may see a renewal of that distress in the shipbuilding trades of the north which was so keenly felt last winter, but there is the consolation that the evil is working out its own cure, and that shipping is adjusting itself to a changed demand; while if that demand should alter and the import and export trades receive a stimulus, the shipping trade will at once recover, and shipbuilding may revive with greater rapidity.—*Times.*

TRIAL TRIP OF A CHANNEL STEAMER.

At the invitation of the directors of the Dublin Steam Packet Company, about 250 guests lest Kingstown on Thursday, August 27th, by the magnificent new cross-channel steamer *Ireland*, on her trial trip to Holyhead. The *Ireland* made the run from Holyhead to Kingstown on Wednesday in two hours and 56½ minutes, being the shortest passage ever made. The next quickest passage between the two places was made a few weeks ago by the steamship *Ulster*, a vessel built by the Messrs. Laird about 25 years ago. The *Ulster* was recently supplied with new engines and boilers, and after this re-fitting she steamed the distance in three hours and seven minutes. As has been already stated, the *Ireland* is a magnificent specimen of naval architecture, graceful as a yacht, with finer lines than probably any sea-going steamer yet built, and of dimensions and power far surpassing any vessel ever turned out for similar service. She has a length over all of 380 ft., or between perpendiculars of 360 ft., with 38 ft. beam, and a depth in hold of 19 ft. 3 in., her tonnage being 2,590 tons o.m. She is built entirely of Siemens steel, in order that the greatest strength may be secured with the minimum of weight—so important for vessels designed for very high speed—and is sub-divided by steel water-tight bulkheads, carried to the upper deck, into eleven compartments, one of these bulkheads being between the engine-room and each boiler-room, so that the engines and each set of boilers are in separate compartments, and in the event of damage to any two compartments the ship would still have sufficient buoyancy. In appearance she much resembles the present mail packets, having a clipper stem, with shield head, and a short bowsprit, a light elliptic counter, two raking masts, and two funnels, a spacious bridge deck amidships, a long poop aft, and hurricane deck forward. The machinery, which has been made by Messrs. Laird, consists of a pair of oscillating engines having cylinders of 102 in. diameter, with 8 ft. 6 in. stroke, which will be supplied with steam at 30 lbs. pressure by eight steel boilers. An arrangement of fans and engines is provided for putting the stokeholes under air pressure, and the machinery develops at full power 6,000 I.H.P. The passenger accommodation is on a scale such as can be only afforded in a vessel of these large dimensions, and is replete with every comfort and luxury which the most fastidious traveller can desire. In the poop is a large saloon about 80 ft. in length, panelled in polished hardwood, with state cabins on either side, and on the deck below is the spacious dining saloon, richly decorated in gold and colour, and with a refreshment buffet at the fore end. Forward of these saloons are the upper and lower ladies' cabins, which are elegant apartments. In all there is accommodation for about 200 first-class passengers, and, in addition, handsome and convenient smoking cabins are provided amidships. A spacious saloon forward is provided for second class. The arrangement of pantries, lavatories, and such like offices is very extensive and complete. The post office arrangements (which form a special feature in the mail boats belonging to this company, enabling the mails to be sorted and stamped during the passage, so as to be ready for delivery on arrival) have been carefully provided for in the new steamer, large rooms having been fitted for the purpose, and a cabin set apart for the post office officials. The vessel throughout is illuminated with the electric light by Messrs. Edmundson & Co., Dublin, with the exception of the post office, which is lighted with Messrs. Pintsch's patent oil gas. The steering gear and anchor gear are worked by steam, and all the arrangements conducing to the safety and comfort of the passengers are of the most modern and improved type. As a work of naval architecture, the *Ireland* reflects the highest credit upon her eminent builders, the Messrs. Laird Brothers. On her preparatory trip on Monday, the new steamer made the high speed of over 21 knots an hour, and the placing of her on the station will mark a new era in the Channel mail service.

Mr. W. H. White has succeeded Sir Nathaniel Barnaby as Director of Naval Construction.

Messrs. Russell & Co., shipbuilders, Greenock, have contracted to build an iron sailing ship of 1500 tons for Mr. James Nourse, London. Contracts are at present few, in consequence of the unprofitable nature of the shipping trade.

The docks to be made at Manchester in connection with the ship canal form the subject of a graphic picture now added to the diorama known as Hamilton's Excursions that is being exhibited in the Free Trade Hall, Manchester.

The Dolphin.—Owing to the extensive nature of the damage sustained by the General Steam Navigation Company's steamer *Dolphin*, which was sunk in the collision off Kingsdown, it has been determined to destroy her where she lies as soon as the cargo can be removed. Divers are now engaged in getting the cargo up, the matter having been taken in hand by the Trinity authorities. From the statement of the divers it appears that nearly the whole of the starboard side of the vessel from abaft the paddle box is torn out.

The following figures concerning the *Great Eastern* and the *Ark* are of interest. Somebody is comparing the size and cost of the *Great Eastern* and *Noah's Ark*. The cost of building and launching the *Great Eastern* was 3,650,000 dols., and this broke the original company. A new company was formed, which spent 600,000 dols. in fitting and furnishing her. Then this company failed, and a new company was organised, with a capital of 500,000 dols. At the close of 1880 this company sunk £86,715 upon the vessel, thus making her total cost 4,703,575 dols. Nothing ever built can stand comparison with the *Great Eastern*, excepting *Noah's Ark*, and even this vessel could not match her. The length of the *Ark* was 300 cubits, her breadth 50 cubits, and her height 30 cubits. The cubit of the Scriptures, according to Bishop Wilkins, was $21\frac{65}{100}$ in., and computed into English measurement the *Ark* was 547 ft. long, 91 ft. beam, $54\frac{1}{10}$ ft. depth, and 21,762 tons. The *Great Eastern* is 680 ft. long, 83 ft. beam, 56 ft. depth, and 28,093 tons measurement. So *Noah's Ark* is quite over-shadowed by the *Great Eastern*.

THE HISTORY OF PADDLE-WHEEL STEAM NAVIGATION.*

(*Continued from page* 161.)

By Mr. Henry Sandham, of London.

It is impossible within the compass of this paper to do justice to the many rapid and remarkable strides made in iron-ship-building between the years 1850 and 1860, even though attention be confined to paddle-wheel steamers only. Details of many vessels not mentioned but of great importance will be furnished in time it is hoped to this Institution. Such information about early paddle-wheel steamers and their performances is greatly wanted. As an instance may be quoted the *Wave Queen*, 210 ft. by 15 ft., 80 N.H.P., designed and built in 1852 by the late J. Scott Russell. Since 1860 a gradual decline of paddle-wheel steamers seems to have set in.

In 1861 the celebrated paddle-wheel Cunard liner *Scotia* was built of iron at Glasgow by R. Napier & Sons. She was 4,050 tons burden, 1,000 N.H.P., with side lever engines having cylinders of 100 in. diameter and 12 ft. stroke. She is the last of the Atlantic ocean paddle steamships. In 1871 she was sold, and is now a twin-screw steamship, altered and engined by Laird Brothers. The *Scotia* was preceded by the *Persia*, 3,585 tons burden, 1,200 N.H.P., speed $11\frac{3}{8}$ knots per hour, built of iron and engined by R. Napier & Sons in 1856.

The diagonal system for wooden ship building of Messrs. Johns and O. Lang, once called the "lath and plaster" system, was first tried on the Thames about 1834-37 in the construction of the steamers *Ruby*, *Red Rover*, *City of Canterbury*, and others. The composite construction of ships—partly iron and partly wood—was introduced by Ditchburn & Mare, of Rotherhithe, in 1844, in building one of the Waterman Woolwich packets, and in the *Little Western* paddle-steamer. The first iron steam-vessel built on the Thames was the *Daylight* paddle-steamer, by Ditchburn and Mare, 1838. Messrs. Samuda Brothers and J. & G. Rennie, in 1857, turned out the first steel-built vessels on the Thames.

The compound expansion engine was first proposed by Jonathan Hornblower in 1776, and in 1804 was improved by Arthur Woolf, by whose name it is still designated. In 1872-73 a powerful set of oscillating engines on the compound system was placed by Messrs. Laird Brothers in a paddle-wheel steamer built by them at Birkenhead.

The *Era* paddle-steamer, 1841, was fitted by Spiller, of Battersea, with a compound or Woolf engine, having cylinders $17\frac{3}{8}$ in. and 20 in. in diameter, stroke 20 in. Mr. Spiller's water-tube boiler supplied steam at 40 lbs. per square inch. A surface condenser and steam regenerator, on the system of Mr. Zander, a Swedish engineer, was fitted to the engine. Coke was used as fuel.

As regards steamers employed in the various channel and sea routes around Britain, the screw-propeller is gradually superseding the paddle-wheel. A notable instance is in the fleet of steamers of the Great Eastern Railway now running between Harwich and Antwerp. So late as 1880 a powerful paddle iron steamer, the *Lady Tyler*, was built by Messrs. T. & W. Smith, Newcastle, for this service, and was fitted with compound steeple engines by Messrs. R. & W. Hawthorn. Each engine has three cylinders, one of 33 in. and two of 44 in. diameter, and 5 ft. stroke; boiler pressure 70 lbs. per square inch. She has since been rivalled by twin screw-vessels, the *Norwich* and the *Ipswich*, built in 1883 by Earle's Shipbuilding Co., Hull, of 1,400 tons burden, with engines of 300 N.H.P. collectively; speed 13 knots per hour.

Home Services.—The various home-services still performed with paddle-steamers are, so far as the compiler knows, as follows:—

Holyhead and Kingstown. In early days the Admiralty fulfilled the mail service. The City of Dublin Steam Packet Co.'s paddle-steamers: *Leinster*, *Ulster*, *Munster*, and *Connaught*, four sister vessels, iron built in 1860 by Messrs. Samuda Brothers and Messrs. Laird Brothers, about 34 ft. by 35 ft. by 20 ft.; 2,039 tons burden, 720 to 750 N.H.P., speed 21 miles per hour. The engines are oscillating, those of the *Leinster* and *Connaught* by Ravenhill & Co., those of the *Ulster* and *Munster* by Boulton and Watt. The feathering-float paddle-wheels are 34 ft. full diameter, each having fourteen floats of 12 ft. length and 4 ft. depth; their dip is $5\frac{3}{4}$ ft. at deep draught. These steamers are now under alteration and improvement by Messrs. Laird. They will be assisted by a new vessel, the *Ireland*, steel-built, 380 ft. by 38 ft., oscillating engines 6,000 N.H.P., speed 20 knots per hour, building at Birkenhead by Laird Brothers.

The London and North-Western Railway fleet plying between Holyhead and North Wall, Dublin, built of iron. The *Violet* and *Lily*, built in 1880 at Birkenhead by Laird Brothers with engines of 3,000 I.H.P., represent their earlier sisters *Rose*, *Shamrock*, *Eleanor*, and others. The newest vessel is the *Banshee*, built in 1884 by Laird Brothers, 310 ft. by 34 ft. by 14 ft., 1,781 tons, 3,500 I.H.P., speed 19 knots per hour.

The London and South-Western Railway service between Southampton and Havre is run by the *Southampton* and other steamers. One of them, not long since on this station, had powerful condensing engines on Seaward's atmospheric principle of 1850. She, and the Thames steamer *Sapphire*, are the only two vessels the compiler is aware of that were fitted with engines on this plan. The engines had three vertical fixed cylinders with open tops, the down stroke of the pistons being consequently due to atmospheric pressure. A small working engine on the same principle was exhibited by Messrs. Seaward in 1855 at the Paris Exhibition, and is now in the Conservatoire des Arts et Métiers.

The Channel Islands service, worked from Southampton and Weymouth, by the South-Western and Great Western Railways. The *Normandy*, iron-built 1863 by James Ash, Millwall, 210 ft. by 24 ft. by 14 ft., had oscillating engines of 220 N.H.P. by John Stewart & Co., Poplar, with surface condensers; boiler pressure 22 lbs. per square inch, speed $14\frac{1}{2}$ knots per hour. The *Cygnus*, *Aquila*, and other paddle-steamers are still running.

Milford Haven to Waterford and Cork. Paddle steamers of the Great Western Railway, built by Messrs. W. Simons & Co., of Renfrew, in 1877. The vessels are fitted with compound oscillating engines having cylinders 50 in. and 90 in. diameter with 6 ft. stroke, and paddle-wheels 24 ft. diameter.

Bristol to Cork and Waterford: information wanting.

Liverpool and Fleetwood to the Isle of Man: worked by the Isle of Man Steam Packet Co., Douglas. The smallest vessel is 518 tons gross. The largest, *Mona's Isle*, is 1,500 tons gross, and measures 330 ft. by 38 ft. by 15 ft., with 4,500 I.H.P. This service has acquired a new paddle-steamer, *Mona's Queen*, built in 1885 of steel throughout, by the Barrow-in-Furness Shipbuilding Company, of 5,000 I.H.P.

Barrow-in-Furness to Belfast and the Isle of Man. Modern paddle-wheel steamers built of steel in 1880-83, chiefly by the Barrow Shipbuilding Company.

Queenborough and Flushing. A recent service of paddle-steamers started by the Netherlands Zeeland Steamship Company in 1876 with English-built vessels. They have oscillating engines on the compound system. The *Princess Marie*, built of iron in 1877 by John Elder & Co., Govan, 1,652 tons gross, 600 N.H.P., is a type of the fleet; she is 278 ft. by 35 ft. by $24\frac{1}{2}$ ft. The compound oscillating engines, with boilers, and machinery, are by Elder Co.

The Folkestone and Boulogne service of the South-Eastern Railway, worked for many years now, has been refurnished with modern vessels, of which the *Albert Victor*, built in 1880 by Messrs. Samuda Brothers, of Poplar, and fitted with oscillating engines by Messrs. J. Penn & Sons, is a representative. In 1845-6 the steamer *Prince Ernest*, and in 1846-7 the *Lord Warden*, and others, 446 tons, 160 N.H.P., were built by Messrs. Laird for this service.

The Dover and Calais service was carried on by the Admiralty up to 1840 inclusive. Among the earliest mail-boats were the wooden paddle-steamers *Ariel*, 152 tons, 60 N.H.P.; *Beaver*, 128 tons, 62 N.H.P.; *Swallow*, 133 tons, 70 N.H.P.; and *Widgeon*, 162 tons, 90 N.H.P. They were followed by iron built vessels, of which the first on the station was the *Dover*, by Laird Brothers, 1840; 113 ft. by 21 ft. by $9\frac{3}{4}$ ft., 228 tons, 90 N.H.P. This service is now fulfilled by the London, Chatham and Dover Railway and the South-Eastern Railway. The *Princess Mary* and *Princess Maud* were built in 1844; the latter, by Ditchburn and Mare, were fitted with Maudslay & Field's vertical engines on the "annular" system of Joseph Maudslay, 120 N.H.P.; her paddle-wheels were 19 ft. 4 in. diameter. The *Princess Alice* had also been fitted with similar engines in 1843. The *Samphire*, an old favourite on this station, has diagonal engines by Ravenhill, with two oscillating cylinders placed opposite each other on the keel line, driving the cranks on the paddle shafts. More powerful and newer vessels of note on this station are the *Maid of Kent*, *Wave*, *Foam*, and *Breeze*. A still newer vessel in this service is the *Invicta*, built of steel in 1882 by the Thames Ironworks Company, Millwall. Her dimensions are 312 ft. by 33 ft. by $17\frac{1}{4}$ ft., draught of water $8\frac{1}{2}$ ft., 1,647 tons. Her engines, by Maudslay & Field, are 4,000 I.H.P., and have oscillating cylinders 80 in. diameter with $6\frac{1}{2}$ ft. stroke; boiler pressure, 30 lbs. per square inch. The *Invicta* has been followed by the *Princess Beatrice*.

The Dover and Ostend mail service was also in early days conducted by the Admiralty. It is now performed by the Belgian

* *Read at a Meeting of the Institution of Mechanical Engineers, March* 20.

Government with iron-built paddle-steamers of high speed, constructed and engined by the Société Cockerill, Seraing, Belgium.

The Newhaven and Dieppe service, worked by the London Brighton and South Coast Railway, beginning with small steamers on account of the bad entrance channel to Newhaven harbour. The newer paddle-wheel vessels employed are the *Brighton* and *Victoria*, built of steel in 1878 and engined by John Elder & Co., Govan. Dimensions 220 ft. by 27½ ft. by 11½ ft., 819 tons, engines of 300 N.H.P.

Channel Service.—In connection with channel steamers, mention must not be omitted of the attempts which have been made, and are still probably under consideration, to prevent the passage from being unpleasant under any circumstances of sea, wind, or weather. The paddle-steamers *Castalia*, *Calais-Douvres*, and *Bessemer*, have been constructed to accomplish this problem.

The *Castalia* was built in 1874 by the Thames Ironworks Company, from designs by Captain T. W. Y. Dicey. She had two half-ship hulls, held firmly parallel, with space between them for the paddle-wheels. Her extreme length was 290 ft., extreme breadth 60 ft., draught of water 6 ft. The engines were on the diagonal arrangement. The machinery was constructed by Messrs. J. & A. Blyth & Co. The career of the *Castalia* was neither satisfactory nor enduring; her collective engine power was 260 N.H.P.

In 1877 Messrs. Leslie, of Hebburn, Newcastle, built another double-hull vessel, at first called the *Express*, but now known as the *Calais-Douvres*. She differed from the *Castalia* in having two complete hulls, which, though separated, were kept together parallel to each other by strong wrought-iron girders. She is 300 ft. by 60 ft., and has engines of 4,000 I.H.P. The paddle-wheels are placed between the two hulls. She commenced duty in May, 1878, and has kept her station since between Dover and Calais in the service of the London Chatham and Dover Railway. The steamer *London Engineer*, 70 N.H.P., built and engined in 1818 by Messrs. Maudslay & Field, is an early example of a vessel with centre paddle-wheel.

The *Bessemer* paddle-steamer, iron built at Hull, by Earle's Shipbuilding Co., was launched in 1875. She had a complete ship's hull, and in the centre of her length was slung a large swinging saloon, controlled by hydraulic arrangement and skilled labour, so as to keep the saloon always on the level irrespective of the movements of the ship's hull. The saloon and apparatus were designed by Sir Henry Bessemer. The ship was tried at sea in January, 1875, and obtained a speed of 19 to 20 miles per hour. She had four paddle-wheels, two on each side of her hull, fore and aft, thus reverting to the plan of Bell's *Comet* of 1811; there were two sets of engines for each pair of wheels. The vessel was 350 ft. long by 40 ft. beam. Her engines, by Earle's Co., were 4,000 I.H.P. collectively. Both pairs of feathering-float wheels driven by them were 30 ft. in diameter, and were placed 106 ft. distant from each other fore and aft.

Saloon Steamers.—The class of paddle-steamers known as saloon-steamers is due to America. The saloon, or passenger accommodation entirely on the upper deck, has long been in vogue in the United States and Canada; but here the plan was not taken up until 1863, when the *Iona*, paddle-steamer on the Clyde, was constructed by Messrs. J. & G. Thomson, of Govan and Glasgow, for the Scottish Tourist service of Messrs. D. Hutchinson & Co. The *Iona* is 245 ft. by 25 ft. by 9 ft.; draught a little over 4 ft. Her engines, by Messrs. J. & G. Thomson, have oscillating cylinders 46 in. diameter with 4 ft. stroke; they make 42 revolutions per minute, equal to a piston-speed of 336 ft., and drive paddle-wheels 20 ft. diameter. On the upper deck is a saloon of 180 ft. total length, the top of which forms a promenade. The *Iona* has been followed by a larger vessel on the same plan, called the *Columbia*.

Saloon steamers were introduced on the Thames in 1866. The two first were the *Albert Edward* and *Princess Alice*, built for service on the Clyde by Messrs. Caird & Co., of Greenock. The *Princess Alice* was 219½ ft. by 20 ft. by 9½ ft., 251 tons, 140 N.H.P. On 3rd September, 1878, she was totally lost in the river by collision with the screw-steamer *Bywell Castle*.

(*To be continued.*)

Messrs. Davis and Co., Limited, Poplar, London, have been awarded silver medals at the inventions and at the Antwerp Exhibition for their patent steam-steering machinery. This is the highest award for this machinery at both Exhibitions.

THE NEW ARMOURCLAD.

As already stated, the Admiralty have appropriated a sum of money in the current estimates for the laying down at Portsmouth of a new armourclad of the *Dreadnought* type. The amount is small, and only sufficient to cover the expense of the preliminary preparations, as no substantial progress can be made with the ship until after the launch of the *Camperdown* (which cannot take place sooner than the end of the year) frees the slip on which it is proposed to construct it. In their report Lord Dufferin's Committee of Designs of Ships of War, after pointing out various weaknesses in the *Devastation* and *Thunderer*, which were too far advanced at the time to have any structural alterations introduced in them, hazarded the remark, in which the members unanimously agreed, that, subject to any improvements which further investigations might render possible, the *Devastation* class "represented in its broad features the first-class fighting ship of the immediate future." And they added that some at least of the ships of the class ought to have armour as much more than 12 inches in thickness as was compatible with manageable dimensions of hull. The natural outcome of these recommendations was that in the construction of the *Dreadnought*, the displacement rose from 9,330 tons to 10,820 tons, while the side armour was increased from 12 inches to 14 inches, and the guns from 35 tons to 38 tons. A further modification was introduced by bringing the forward and after parts of the ship flush with the top of the citadel, and extending the armoured protection to the sides, and thus improving not only her seaworthiness but her interior accommodation. The *Dreadnought* is only now serving her first commission, but the reports of her behaviour are sufficiently favourable to authorise the building of an improved duplicate.

It will thus be seen that the new armourclad will signalise almost as wide a departure from ships of the *Colossus* and *Inflexible* type as from the Admirals. In the first place she will be a double-turret ship, which will distinguish her from barbette ships of the *Collingwood* class; then she will have her turrets built on the centre line, which will distinguish her from the *Colossus* class; while, as she will besides be fitted with a citadel, be completely belted with armour 20 inches in thickness, she will be equally distinguished from both the classes of ships named. Monitors are little more than contrivances for floating guns and protecting them in action, and in his evidence, given before the Committee on Building and Repairing Ships, the late Director of Naval Construction allowed it to be sufficiently known under what disadvantages his department laboured in being obliged to build the carriages without knowing the kind of guns they were fated to carry. All our ships are designed for an unknown gun. Beyond the knowledge that it will weigh about 40 tons, we know nothing, and we have to wait for years before we do know.

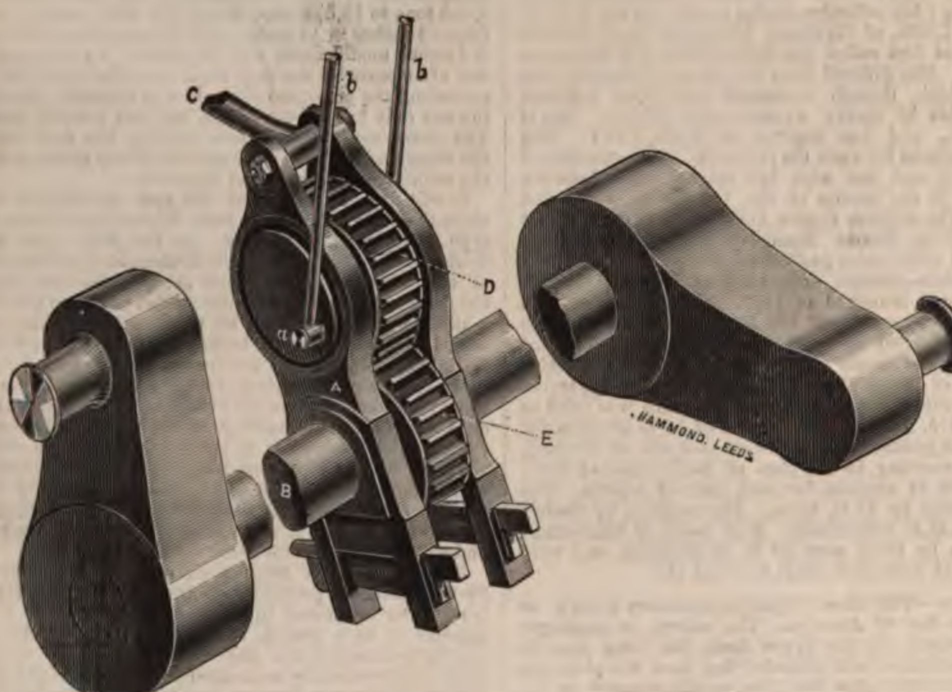
Now, as the new armourclad is to carry in her turrets four 68-ton guns, the probability is that the constructive department is no better informed in the present case. The new ordnance appears to be a growth and development of the 63-ton guns originally intended for the armament of the *Camperdown*, and what will eventually be decided as to the weight of its charges and projectiles will have to be taken to a large extent upon trust by the designers of the ship. But while these essential details connected with the guns remain undecided, the dimensions of the vessel which has to carry them have necessarily been determined. She will have a length between perpendiculars of 345 ft., a beam of 73 ft., and a displacement of 12,000 tons. That is to say, in order to enable her to mount the same number of turret guns as her prototype, the *Dreadnought*, but 30 tons each heavier, it is deemed imperative to make her 25 feet longer, 5 feet 2 inches broader, and 1,110 tons heavier. The turrets, as has been said, will be built along the middle line of the ship, instead of diagonally as in the *Colossus* type. The side armour will be brought up sufficiently high to form a protected battery for eight 6-inch guns, and light rapid-firing guns will be distributed throughout the ship. Besides these she will carry the usual complement of machine guns and Whitehead torpedoes. Her propelling machinery remains for after consideration; but it is understood that the stokeholds will be fitted for forced draughts and that she will realise a speed of 18 knots, or four knots in excess of the *Dreadnought*, and two over the *Colossus*.

A boiler explosion has occurred on board the *City of Oxford* transport while on her way to Glasgow. Several men were injured, and Thomas Bath, fireman, of Portsmouth, was killed.

BEVERIDGE'S PATENT VALVE GEAR.

AMONGST the most novel departures in engine valve gear we notice the exhibit in the International Inventions Exhibition of Mr. James Beveridge, of Soho foundry, Barrow-in-Furness, which certainly seems to mark a considerable advance on the old eccentric and slotted link valve gears.

The apparatus, as will very readily be seen from our diagram, consists of a cogwheel, E, keyed to the crank shaft and gearing into another cogwheel D, carried the crank shaft. Thus one set of this mechanism, as shown, performs all the functions of four eccentrics, straps, and a double-link motion, and is evidently a simpler and more inexpensive construction. Some objection may be taken to the use of gearing for the purpose, but this objection is more fanciful than real, provided that the surface and pitch of the wheels are well made, so as to insure perfect uniformity of motion, in which case they can easily be made to run quite noiselessly, and certainly to outlast the eccentric gear which it is proposed they should supersede. The wheels are double-shrouded to take any undue strain off the teeth which would probably be made from the hardest steel or gun metal. The reversal of the engine is very easily and rapidly effected



BEVERIDGE'S PATENT VALVE GEAR.

in a framing A capable of movement round the axis of the crank shaft. The cogwheel D is provided with two disc plates, one on either side of the frame, in which are fitted the disc pins A, to which valve rods B B are attached; the revolution of the cogwheel D gives the necessary reciprocating movement to these valve rods by which the ordinary slide valve may be operated. It is obvious that the revolution of the one wheel D will serve to drive an under valve and upper expansion valve if the disc pins A are set relatively in proper position. Also any required lead can be given to either of the valves by virtue of the exact position of the disc pins A. A reversal in the engine and valve gear can also be obtained by throwing over the links of the reversing rod C to a corresponding angular position on the opposite side of by this gear. There is a total absence of vibration, and such wear and tear as may take place does not materially affect the setting of the valve.

A SCHEME, said to be promoted by the Midland Railway Company, has been recently submitted to a number of freighters and merchants for the construction of a large dock on the foreshore near New Dock, Cardiff, intended chiefly for the Atlantic trade. Surveys have been made and plans prepared for constructing a low-water dock, 320 acres in water area, and accessible to ships drawing 22 ft. of water at all states of the tide. The estimated cost is to be one and a-half million. The dock is to be connected with Cardiff Docks, and all local railways, and by the Taff Vale and Rhymney with the Midland Railway. The dock is to have a regular line of steamers plying between Cardiff and New York, and also ports of the south side of the Bristol Channel.

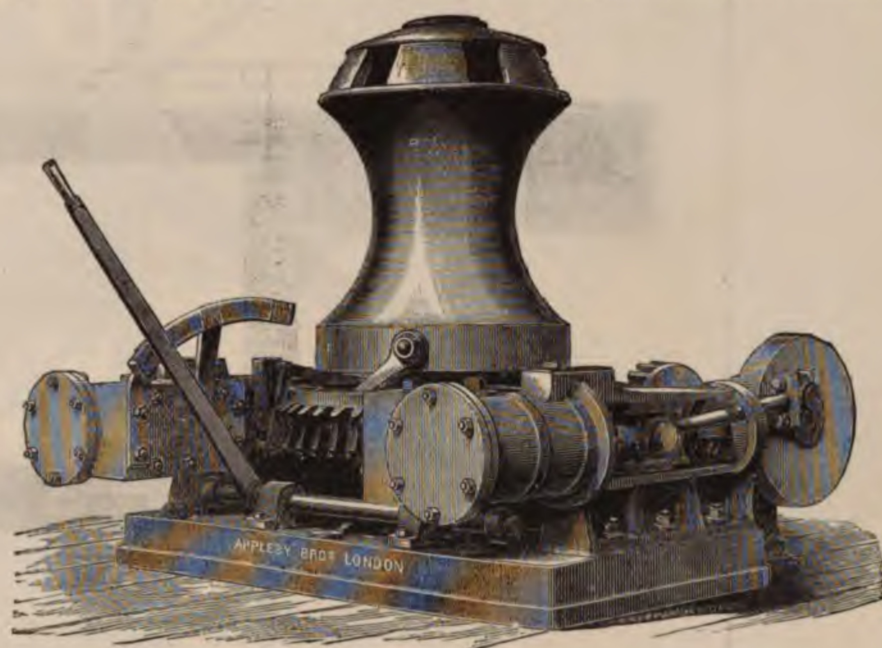
IMPROVED STEAM CAPSTAN.

WE notice as one of the practical exhibits at the "Inventories," and likely to be of interest to our readers, a very neat and compact steam capstan, manufactured by Messrs. Appleby Bros., of East Greenwich, and which we illustrate herewith.

A very important point has been kept in view in this design, viz., the capstan head is not rigidly connected to the steam driving gear, but is driven through the intervention of pawls on a ratchet face. Should, therefore, no steam be available, or the engine be in any way out of gear, the capstan can be worked by hand with the usual bars.

The engines form a pair, driving at right angles to each other upon the shaft, which is fitted with a disc plate at each end. Upon the engine shaft are two sets of gearing to give alternative speeds, either of which wheels may be thrown into gear with an intermediate shaft, carrying a worm that gears into the worm wheel at the base of the capstan, which drives the capstan head by means of the pawls. The engines are horizontal, and bolted to a strong box frame which carries all the gear, and which can then be conveniently covered over on board a vessel, or sunk below the ground when fixed on a wharf or pier head for warping vessels in and out of dock.

The whole job is very neat, strong, and compact, and is made for good service rather than show.



IMPROVED STEAM CAPSTAN.

THE NEW SALAMANDER LUBRICANT.

ASBESTOS is now being very largely used for gland packing, and the United Asbestos Company, Limited, seem to have a very large monopoly of supply with asbestos for that purpose. To obtain, however, the full benefit of such packing, a great deal depends upon the kind of lubricant that is used. Any free acid in the lubricant or development of acid will very quickly clog the packing and leave a hard glazed surface of partly decomposed oil and carbonaceous matter, and render the packing inelastic. The United Asbestos Company, Limited, have very sensibly devoted much time and attention to produce a lubricant without these drawbacks, so that when used with the asbestos packing the best possible results shall be obtained. They seem to have succeeded in producing in the Salamander lubricant an oil, which tested on the brake, gives results far superior to most other lubricants at present in the market, and which is the primary necessity of a good lubricant —a total absence of free acid.

From the analysis it is evidently a pure mineral neutral oil; vegetable and animal oils are entirely absent, free acid being also absent. The melting point is 125° F., the solidifying point 120° F., and the flashing point 384° F. We have extracted these particulars from the analysis of R. H. Harland, F.I.C., F.C.S., Public Analyist to the Greenwich Board of Works, which proves this grease to be a pure hydro-carbon.

The action of steam will not develop any acid at the highest pressure from this lubricant, nor will it deprive asbestos packing of its original elasticity. Its low melting point and high flashing point renders it a safe and, at the same time, an economical lubricant. It leaves no residue or sediment, being as low as ·04 per cent., and it will not gum under any circumstances. It is recommended that when this lubricant is first applied, the old grease should be first cleared away, and that a little of the Salamander should be rubbed over the bearing.

A copper worm is used in the lubricating box in the same manner as is common with all solid lubricants, the end of the copper worm resting on the shaft.

We hear that this Salamander lubricant has already been very favourably received, both as a packing and lubricant oil, particularly for marine engines.

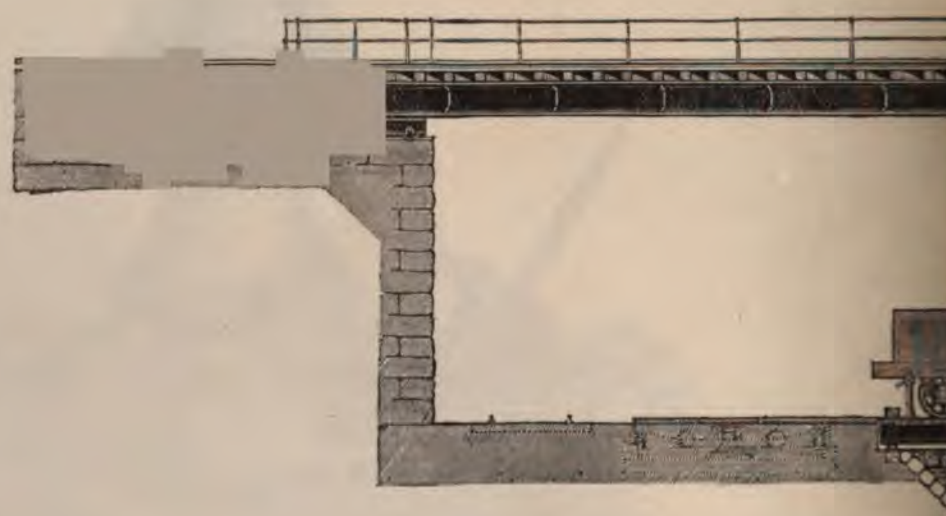
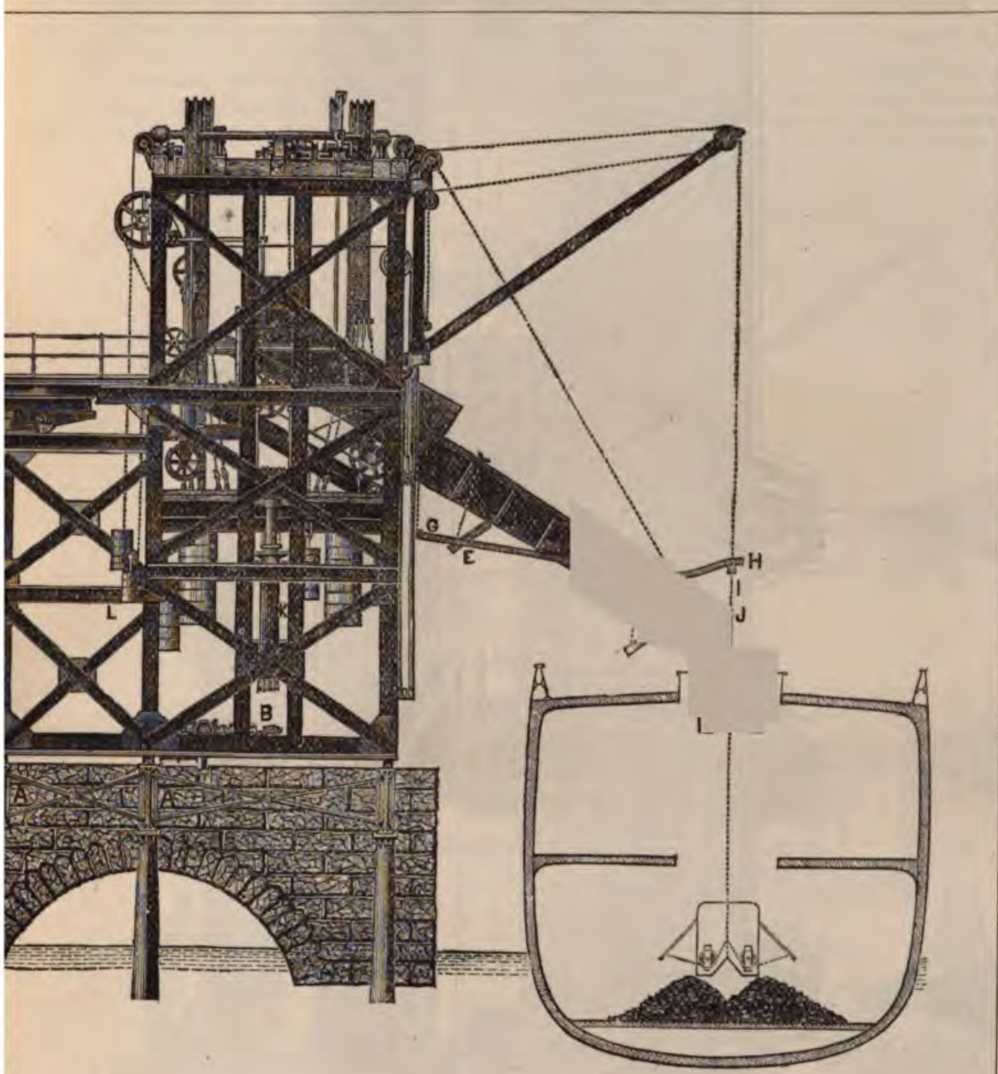


FIG. I.—BUTLER'

BUTLER'S PATENT MOVABLE STAITHS FOR LOADING COAL WITHOUT BREAKAGE.

WE illustrate herewith an important improvement applicable to coal loading staiths. As at present constructed the staiths are usually made a fixture, and the vessel has to accommodate itself to the position of the staith. The result generally is, that only one staith can be employed at a single time to load any vessel, and the vessel must be moved from hatch to hatch to be completely loaded. Butler's patent staith admits of lateral adjustment on the edge of the quay, so that two or three staiths may be used simultaneously for loading vessels, as they will accommodate themselves exactly to the position of the hatchways. This is shown very clearly in figure 2 of our illustrations, which shows the arrangement of the staith in plan. Figure 1 shows a side elevation of the apparatus for shipment of coal from high level railways, and is very similar in general construction to the fixed staiths as at present used, except for the important difference, that the structure of the staith is mounted on wheels travelling on girders A A A in the foundations, and a hydraulic winch B is used for hauling the staith in either direction. To accommodate this movement, the bridge for conveying the wagons to and from the staith is provided with pivot joints and turntables at either end C D, so that communication is retained in all variety of



BALANCE STAITH.

positions. The end of the bridge at C is mounted on a carriage which permits a sliding movement on that end to the bridge, together with the pivot movement as before described, sliding rails and foot plates being provided to span the gap as it is created, so that wagons may be travelling on the bridge even at the time the staith is moving. The hydraulic connection with the staith is also telescoped, so that the joint remains in like manner, always connected, while the staith is moving.

Another new feature of considerable importance is also fitted to these staiths, and might be fitted to any staith now working, to reduce breakage to a minimum. This apparatus consists of a box which is constructed to work automatically so as to receive the coal from the shoot, and deliver it quietly at any desired depth in the hold. The bottom of the shoot, for about 3 feet from the end, is made to lift on a rocking shaft beneath it, actuated by the side lever E, by which it is connected by rods F, and it is balanced by weights at the end of the staith, attached by chains to the ends of the side levers G. Guide rollers are provided in the end of the lever H, by which the anti-breakage box is kept square with the shoot. Another chain is also provided to the anti-breakage box for he operation of two side doors in the said box, through which the coal is delivered into the hold. The box is lifted and lowered by one chain worked by the hydraulic cylinder K, whilst chains operating the doors are kept tight by the weight L, and are released by large links in

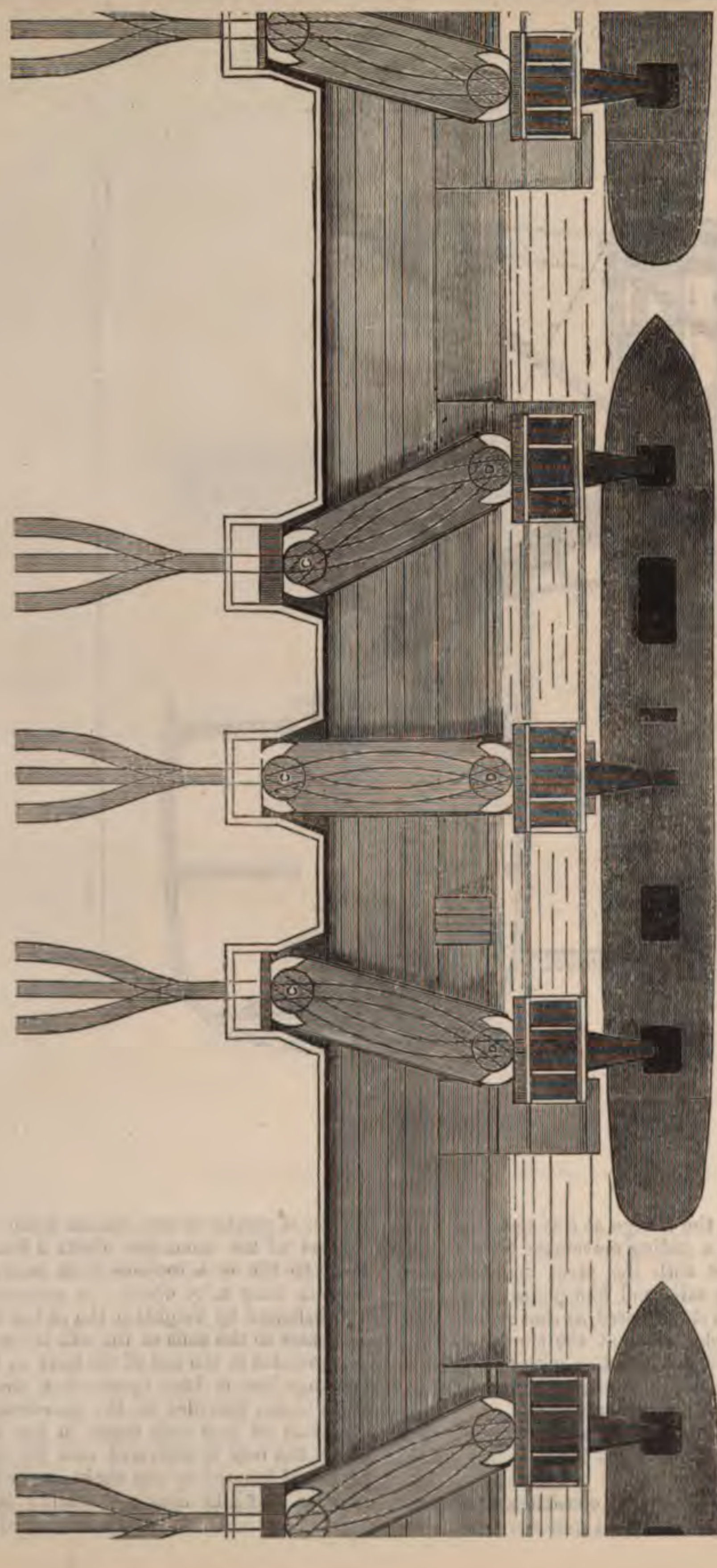


FIG. 2.—BUTLER'S PATENT MOVABLE BALANCE STAITH.

the chain coming into contact with an adjustable stop, the doors being thereby allowed to open, and the coal discharged. The required depth at which the box is required to discharge may be adjusted at any time. This box therefore performs a double automatic action. It opens the mouth of the shoot only when it is in a proper position to be filled, and allows it to close immediately it begins to descend, and upon reaching the right position for discharge automatically opens its side and delivers the coal. When not required for the purpose of lowering the coal, it may still be made to act as a wing board for regulating the discharge of the shoot. Figures 3 and 4 show side and back views of the staith as constructed for shipment from low level railways. The wagon is lifted by the hydraulic cylinders A, which is a multiple ram operating wire rope passing over the pulley B. The tipping is done by a weight from the hydraulic cylinder D, which is also a multiple chain ram. In this latter arrangement the bottom hydraulic winch is dispensed with, and the lifting tackle is utilised to shift the staith in either the one way or the other, according to the direction in which one of the lifting chains is passed, the chain being fastened to mooring posts on the quay, at opposite ends of the staith's travel.

The whole arrangement seems to be well designed and practicable, and to greatly increase the facility with which vessels may be loaded.

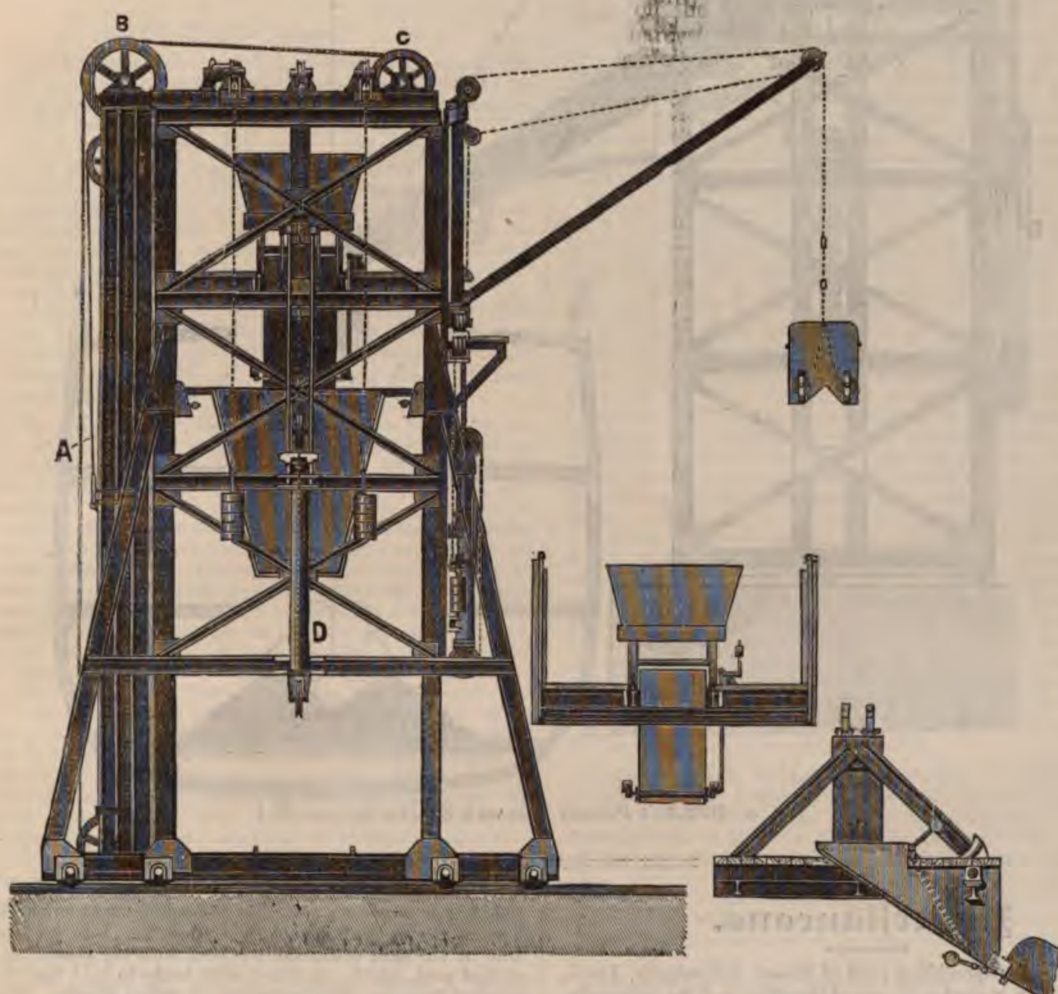


FIG. 3.—BUTLER'S PATENT MOVABLE STAITH.

A MAGNETIC UMBRELLA.

DURING a recent passage of the steamer *Princess Beatrice* from Larne to Stranraer, the man at the wheel called the attention of the commander to the fact that the compass, since a certain passenger had taken up a position near it, had ceased to work truly, the needle being irresistibly attracted towards the stranger. On being questioned the gentleman professed himself unconscious of having anything in the nature of a magnet about him, but a series of experiments ultimately resulted in the discovery that the magnetic influence which had caused the compass to vary to such an extent as to make it unreliable was located in the traveller's umbrella, the slightest movement of which was instantly responded to by the needle. Captain Campbell induced the owner to sell him the umbrella, which, having been tried with similar results on the largest compasses to be found in Belfast, was forwarded to Sir Wm. Thomson for investigation. The matter is of some importance, since it is obvious that the compass, in a fog, for instance, would be a very unsafe guide to steer by if its indications were liable to be falsified by the accidental proximity of an umbrella.

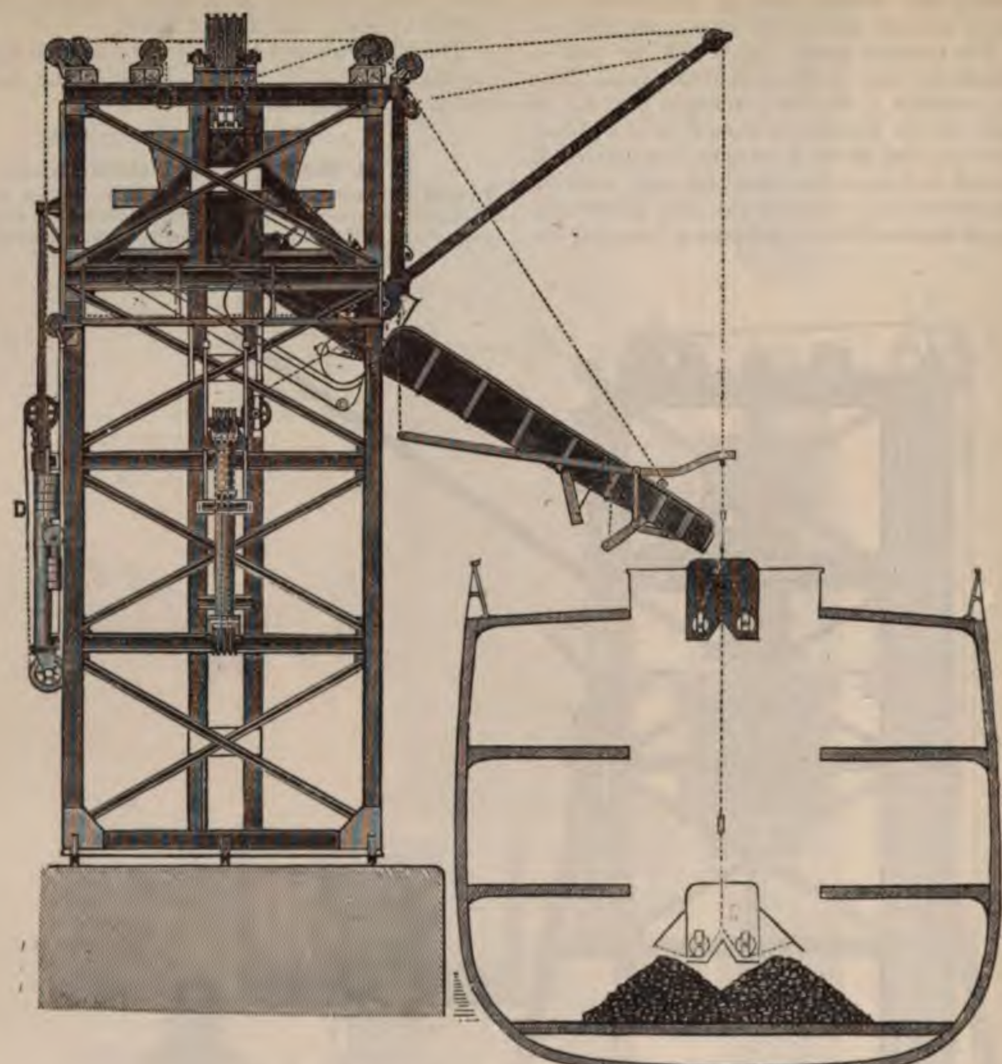


FIG. 4.—BUTLER'S PATENT MOVABLE STAITH (*see page* 182.)

Miscellaneous.

THE Wallsend shipbuilding yard of Messrs. Schlesinger, Davis, and Co. has been inspected by one of the officials of the Admiralty, and the name of the firm has been placed on the "Admiralty List" as builders of vessels for the British Government.

THE British Steamship Owners Protective Association have passed a vote of thanks to the Load-Line Committee "for the painstaking and thorough manner they have fulfilled the task allotted to them." The Sunderland shipowners have passed a similar resolution.

THE new unarmoured gun vessel *Swallow* will be launched at Sheerness on the 27th of October. She is 195 ft. long, 1,040 tons displacement, and will have engines of 1,000 I.H.P. by Messrs. J. & G. Rennie.

THE *Hero*, under construction at Chatham Dockyard, is ordered to be launched on the 27th of October. She is a twin-screw steel armoured turret ship, and will have an estimated displacement of 6,200 tons. She will be fitted with machinery of 4,500 H.P.

A CONTEMPORARY says a line of steamers is about to run between Rome and Genoa, and that the two pioneer boats destined to open the Tiber once more as a highway of commerce have been built by a Newcastle firm.

A DAILY paper reports that some important experiments have been made at Middlesbrough with liquid fuel for steamships. One of the most successful has been with the steamship *Emanuel*, of that port, which was fitted with tanks to hold the oil, a waste product from the Middlesbrough Chemical Works. The steamer has just returned from a trip to the Mediterranean, and the master and the engineer report most favourable results.

THE official report of the Registrar-General of Shipping and Seamen states that in the past month there were added to the registers of the United Kingdom and the colonies 114 vessels, the net register tonnage of which was 38,974. In the same time the number of vessels removed from the registry was 166, the net tonnage being 37,915. Out of the vessels added only thirty-six were steamers, and many of these were of small dimensions, for river or special service. The chief addition to the tonnage last month was in the iron sailing vessels—fifteen being added to the register for the United Kingdom, of the net registered tonnage of 19,787. All the wooden sailing vessels added to the United Kingdom and colonial registers last month were of small dimensions, with one exception, so that it would seem that there are now very few large vessels being built. Taking both home and colonial registers, the horse-power of the vessels added last month was 2,708, and that of the vessels removed was 3,158, so that the effective carrying power is being reduced.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—ED. M. E.]

LAUNCHES.—ENGLISH.

Cabo Trafalgar.—On August 25th Messrs. C. S. Swan and Hunter launched from their shipbuilding yard, at Wallsend-on-Tyne, an iron screw steamer of the following dimensions:—Length, 260 ft.; breadth, 35 ft.; depth, moulded, 19 ft. 3 in. The vessel is fitted with a long full poop, extending over and forward of the engines and boilers, long top-gallant forecastle, water ballast in a cellular double bottom all fore and aft, four steam winches, steam-steering gear, patent windlass, iron main deck, and all modern appliances. There will be accommodation for twenty first-class passengers, with a large deck-house for entrance to saloon and smoke room. The engines are on the triple expansion surface condensing principle, by Messrs. Blair & Co., Limited, Stockton-on-Tees, and capable of indicating about 900 H.P. As she left the ways the name of the *Cabo Trafalgar* was given by Miss Grace, of Selby. This vessel has been built to the order of Messrs. Ybarra & Co., of Seville, under the superintendence of Senor Emilio Valdes.

Suez.—On August 27th Messrs. W. Gray & Co. launched from their yard a fine screw steamer of the following dimensions 285 ft. by 37 ft. 2 in. by 21 ft. 8 in. moulded, to carry over 3,000 tons, built of steel to the order of Messrs. Thos. Appleby & Co., West Hartlepool, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type, with poop aft, containing handsome saloon and cabins for officers and a few passengers, long raised quarter-decks connected to bridge amidships, the latter being carried over the machinery space, coal bunkers and main hatch right forward of the foremast, thus covering in the lowest part of the vessel, and adding greatly to her strength and stability. The crew are housed in the fore part of this extended bridge, which will add much to their comfort. The usual topgallant forecastle is fitted forward with Emerson, Walker & Co.'s patent combination capstan windlass. She has five hatches, four steam winches, two donkey boilers, and water-ballast in double bottom under each hold, and is in every respect well equipped for general trading, the small boats being carried on beams overhead about 17 ft. above the load-line, and the signal lamps in light towers for extra safety. The engines, which are on the three cylinder triple expansion principle, are being supplied by Messrs. Blair & Co., Limited, Stockton-on-Tees. The christening ceremony was performed by Sir George Elliot, Bart., M.P., amid the cheers of the spectators, the vessel being named *Suez*. She has been superintended during construction by Capt. Baker on behalf of the owners, and is the seventh vessel owned by Messrs. Appleby and Co. which has been built by Messrs. Gray & Co. There were also present at the launch Mr. and Mrs. Appleby, Misses Etta and Maud Appleby, Master Stanley Appleby, Mrs. Cameron, wife of Colonel Cameron, Drs. Gourley and Tweddle, Mr. H. Byron Reed, and Mr. Leslie Darlington, Mr. Watson, Bernard Castle, T. S. Hudson, Esq., and J. H. Murrell, Esq., West Hartlepool, &c.

Buffalo.—On August 29th there was launched from the Jarrow yard of the Palmer Shipbuilding and Iron Company, Limited, the steel screw steamer *Buffalo*, being the latest addition to the fleet of Messrs. Thomas Wilson, Sons & Co., Hull. The dimensions of the vessel are as follows:—Length, 397 ft.; breadth, 45 ft.; depth, moulded, 29 ft. 11 in. The vessel, which has been built entirely of steel, has been constructed to take the highest class at Lloyd's, and is in many respects beyond their requirements. Her gross tonnage is 4,500 tons, net tonnage 2,960 tons, and she will carry 5,000 tons deadweight upon a moderate draught of water. Her engines, also by the Palmer Company, are of the triple expansion type, with cylinders 33 in., 54 in., and 86 in., and 60 in. stroke. Steam is supplied by four large steel boilers, working up to a pressure of 160 lbs. to the square inch. The engines are expected to develop 3,500 I.H.P., and to give a speed of 13 knots, 12½ knots being guaranteed with 5,000 tons of cargo on board. The vessel is fitted with eight improved winches, working at a boiler pressure of 160 lbs. to the square inch, and special condenser and pump. She has four masts, square-rigged on the fore and main; long poop and bridge, extending forward of the mainmast, and long topgallant forecastle. She is divided by twelve bulkheads, and fitted with cellular bottom for water ballast all fore and aft. The main decks are of steel, and fitted to carry 600 head of cattle. Great care has been taken by the numerous sub-divisions of the various holds to provide against the possibility of the cargo shifting. Accommodation for thirty first-class passengers is provided in a large deck-house at the forward end of the poop amidships. The stern frame and rudder are constructed of crucible cast steel. The vessel is fitted with direct steam windlass and all the latest improvements; combined hand and steam steering gear amidships; also screw gear in the after wheel-house, where the quadrant is fitted with an efficient and strong gripping gear for holding the tiller when disconnecting from steam to hand gear. The *Buffalo* will be lighted throughout with the electric light, including mast head and side lamps. Special attention has been paid to the ventilating and fire-extinguishing arrangements, which are of a most complete and comprehensive character. The construction of the vessel has been under the personal supervision of Mr. Wilkins, of Hull.

Volta.—On August 31st this electric launch was successfully put into the water at Greenwich Ferry. The contractors of the new vessel are Messrs. Stephens, Smith & Co., engineers, Millwall, and she was built at Mr. Skelton's yard at Millwall. The hull of the *Volta* is of galvanised steel, and she is 36 ft. long, 7 ft. beam, and 3 ft. 6 in. deep; her draught, with a displacement of 5½ tons, is 26 in. aft and 20 in. forward. There are several novel features worthy of notice in this boat. Two Reckenzaun motors, arranged in a line with the keel, and placed under the floor, are used for driving the screw propeller, in a similar manner as the worm gear is driven in M. Reckenzaun's electric tramcars. By sending the electric current through the motors with their circuits arranged in series or in parallel, or through one motor alone, various speeds and powers are obtained, without introducing artificial resistances or varying the E.M.F. of the battery. Thus, 4, 7, or 12 H.P., equivalent to 5, 9, and 15 I.H.P. of a steam engine, are obtained on the screw shaft at will, with corresponding speeds of the boat. Seventy accumulators of the E.P.S. type furnish the current, which will propel the launch about 40 miles with one charge. These cells are placed at the bottom of the boat, under the floor, so low down as to ballast her in the most perfect manner, such as could not be attained by any steamboat. The vessel is fitted with two masts and sails, to economise the power, when requisite, for longer trips than allowed for in the accumulators. The *Volta* is to make a 40 mile trip down the river Thames, and afterwards a voyage across the English Channel is contemplated.

Torpedo (No. 287).—On September 1st Messrs. Earle's Shipbuilding and Engineering Company, Limited, launched from their yard at Hull a fine steel screw steamship, built for the coasting trade to the order of Messrs. Thomas Wilson, Sons & Co., of the same port. The dimensions of the vessel are as follow: 150 ft. long by 25 ft. beam, 13 ft. depth of hold. She is classed A1* in the Liverpool Registry, has a short poop aft, bridge over engines and boilers, and topgallant forecastle forward. She is provided with water-ballast forward and aft for trimming purposes, and is rigged as a schooner with two pole masts. The rudder is made of cast steel by Messrs. W. Jessop & Sons, of Sheffield. There is accommodation in the poop for captain, and cabin under bridge amidships for the mates and engineers, the crew being berthed in the forecastle. As the vessel is intended primarily for cargo purposes the arrangement of hold, hatches, &c., is such as will afford ample facilities for handy working. She will be fitted by the builders with their triple compound 3-crank engines, having cylinders 14½, 22, and 36 ins. diameter, by 24 ins. stroke, which will be supplied with steam from one single-ended steel boiler made for a working pressure of 150 lbs. to the square inch.

Oliva.—On September 7th there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, the screw steamer *Oliva*, which is built of steel, to the order of Th. Rodenacker, Esq., of Dantzic, under the superintendence of Captain Robert Domke. The dimensions are:—Length over all, 233 ft.; beam, 32 ft.; depth, moulded, 17 ft. 7 in., to class 100 A1 at Lloyd's, built under special survey. The vessel is fitted with a long full poop, extending over and forward of the engines and boilers, long topgallant forecastle, water ballast in the peaks, also in a deep main tank, two steam winches, two steam cranes; patent windlass, and all

modern appliances. The engines are by Messrs. Black, Hawthorn & Co., of Gateshead, capable of indicating 900 H.P. On leaving the ways she was named by Miss Hunter, daughter of one of the builders.

Buccaneer.—On September 8th Messrs. Wigham Richardson and Co. launched at their Neptune Works, on the Tyne, a small screw steamer, called the *Buccaneer*. She is a boat of high speed, 13 knots, and is intended for taking soundings on the coast of Africa, for laying the cable to the Congo. As the steamer may be long in the tropics, the engines, which will indicate from 800 to 1,000 H.P., are of the well-tried compound type, and not on the triplex system with which the firm is so closely identified.

Restitution.—On September 9th Messrs. Wigham Richardson and Co. launched from the Neptune Works, on the Tyne, a large steamer for Messrs. R. Conaway & Co., of Liverpool, called the *Restitution*. She is a ship 350 ft. long, with full poop for passengers, long bridge for officers, and topgallant forecastle for crew, with engines on Tweedy's patent triplex expansion principle, capable of indicating 2,000 H.P., and she will carry nearly 5,000 tons weight. She is built of steel, and to Lloyd's highest classification. The *Restitution* was designed by Messrs. Ashlin and Ashbridge, of Rumford-place, Liverpool, who also drew up the specification and have inspected her during construction. The christening ceremony was performed by Mrs. Richardson. The *Restitution* is specially designed for the Indian trade, and is fitted up with all the appliances which the experience of the designers, the owners, and the builders can suggest, and her scantlings have been fixed to carry the heaviest cargoes, and are much in excess of even Lloyd's requirements. Her frigate-like model was much admired by the company assembled to see the launch. She is built of steel, has the largest capacity which the trade till now allows, economical engines, and machinery to save labour. The winches and other machinery on deck are surface condensing. She is fitted with the steam quarter-master steering gear, Higginson's patent. Her water ballast is arranged specially to suit her cargoes.

Principality.—On September 9th Messrs. W. Doxford and Sons launched a fine four-masted sailing ship, the *Principality*, a sister ship to the *Kate Thomas*, built to the order of Mr. Wm. Thomas, of Liverpool, under the inspection of Captain Jones, who will command her. The vessel is to be classed 100 A1 at Lloyd's, and is of the following dimensions:—Length 258 ft.; breadth, 39 ft. 6 in.; depth, 23 ft. The vessel, when launched, was placed under the firm's masting shears, and all the lower masts put in the same tide.

Chepica.—On September 9th there was launched from the shipbuilding yard of Messrs. Wm. Pickersgill & Sons, Southwick, a handsome iron clipper barque of the following dimensions:—Length, 212 ft.; breadth 34 ft. 6 in.; depth, 20 ft.; classed in the highest class of Lloyd's and Liverpool Underwriters, with additional strength. She has been built to the order of Messrs. S. Wakeman & Son, Liverpool, and is the third vessel constructed by the builders expressly for the South American trade. She is fitted with iron masts and yards, and a large iron house for crew. She also has a patent windlass, supplied by Messrs. Clarke, Chapman & Co., of Gateshead. As the vessel left the ways she was christened by Miss Taylorson, of Sunderland, the *Chepica*. The vessel has been superintended during construction by Captain Swinton.

Heliades.—On September 9th Messrs. Richardson, Duck & Co. launched from their yard a very fine spar-decked steamer, of the following dimensions, viz.:—Length b.p., 320 ft.; breadth, 40 ft.; depth in hold to spar deck, 27 ft. 3 in.; gross tonnage, about 2,900 tons. This steamer has been built to the order of Messrs. R. P. Houston & Co., Liverpool, and will prove a very valuable addition to their weekly line from that port to the River Plate. She is classed 100 A1 on Lloyd's Registry, under special survey, and will also obtain Board of Trade passenger certificate. Her cabins are aft, with accommodation for captain and twenty-four first-class passengers. She has a large deck-house, fitted up for smoke room, ladies' cabin, and wheel house. An enclosed bridge house, over engines and boilers, with accommodation for engineers, officers, petty officers, &c: this house being fitted with iron doors at both ends, making it water-tight, adds materially to the safety of the ship. A look-out bridge forward, and a monkey forecastle for working anchors, the crew and firemen being berthed between decks. Her cargo hatches are unusually large, for the shipment of railway carriages, &c. The lower hold is fitted with web frames, instead of hold beams, for the better stowage of cargo. She has five steam winches, Emerson and Walker's patent independent steam windlass, and Harrison's patent steam steering gear in wheelhouse on bridge. There is a double bottom in after hold for water ballast, and a deep tank in main hold. Sidelights are fitted in between decks, which are unusually high, for the purpose of carrying emigrants if necessary, and which would also make her an excellent transport for the conveyance of horses. She will be rigged as a brigantine. Her engines, of 1,500 I.H.P., will be supplied by Messrs. T. Richardson & Sons, Hartlepool, and are on the triple expansion principle, working pressure being 150 lbs. steam. As the vessel was leaving the ways she was gracefully christened the *Heliades*, by Miss Ellis, the Gynsills, Leicester.

Elizabeth Peers.—On September 10th Messrs. Wm. Thomas and Sons launched from their shipbuilding yard at Amlwch port, a fine iron three-masted schooner, built to Lloyd's highest class, owned by William Postlewaithe, Esq., Millom, Cumberland, which was named *Elizabeth Peers* by Mrs. Peers, wife of Captain Peers, late of the schooner *Rosindale*.

Washington City.—On September 10th Messrs. Edward Withy & Co., Hartlepool, launched a steel screw steamer built to the order of C. Furness, Esq., West Hartlepool, from their yard. Her principal dimensions are 295 ft. by 36 ft. 6 in. by 20 ft. 2 in., with a capacity of about 4,000 tons. The vessel has a long, full poop, 230 ft. in length, and a topgallant forecastle with entrance for the crew from the top, and is fitted with double bottom on Withy's improved longitudinal cellular principle. (This is the 28th vessel built by Messrs. Edward Withy & Co. on this principle.) The steamer is admirably adapted for the conveyance of troops, horses, &c., and is also arranged to suit the American cattle trade. She has five steel watertight bulkheads, and the main deck, bulwarks, rails, skylights, &c., are also of steel. She is fitted with two large donkey boilers by Riley Bros., four steam winches by Clarke, Chapman & Co., patent hand and steam steering gear amidships by Davis & Co., Hastie's right and left screw gear, aft, Emerson, Walker, and Thompson Bros'. patent steam windlass, with Wasteney Smith's patent stockless anchors hauling up into hawse pipes. The saloon for the accommodation of the passengers, captain, and officers is finished in polished hardwood of a neat design. The vessel has been built to pass Lloyd's 100 A1 class, and under the personal superintendence of Captain King. She will be fitted with triple expansion engines, having cylinders 23 in., 37 in., and 60 in. by 36 in. stroke, 250 N.H.P., and two single-ended boilers by Messrs. T. Richardson & Sons, Hartlepool. This type of engines and boilers have proved themselves to be very economical, the consumption of fuel being reduced to a minimum. On leaving the ways the vessel was gracefully christened *Washington City* by Miss Richardson, daughter of T. Richardson, Esq., M.P. A large number of friends, including T. Richardson, Esq., M.P., Misses Richardson, Mr. T. Richardson, jun., Mr. Henry, of Chicago, Mr. and Mrs. C. Furness, Mr. and Mrs. T. Furness, Mr. and Mrs. C. Brown, Mr. and Mrs. Robinson, and a number of other friends, witnessed the launch.

Enfield.—On Thursday, September 10th, Messrs. W. Gray and Co. launched from their yard a fine iron screw steamer of the following dimensions: 285 ft. by 37 ft. 2 in. by 21 ft. 8 in., moulded, to carry over 3,000 tons, built to the order of Messrs. Pyman Bros., London, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type, with poop aft containing handsome saloon and cabins for officers and a few passengers, long raised quarter-deck connected to bridge amidships, the latter being carried over the machinery space, coal bunkers, and main hatch, right forward of the foremast, thus covering in the lowest part of the vessel, and adding greatly to her strength and stability. The crew are housed in the fore part of this extended bridge, which will add much to their comfort. The usual topgallant forecastle is fitted forward with Emerson, Walker & Co.'s patent windlass. She has five hatches, four steam winches, two donkey boilers, and water ballast in double bottom under each hold, and is in every respect well equipped for general trading, the small boats being carried on beams overhead, about 17 ft. above the load line, and the signal lamps in light towers for extra safety. The engines are of the triple expansion type, having three cranks, and are manufactured by the Central Marine Engineering Company, of West Hartlepool. They have cylinders of 21 in., 35 in., and 57 in. diameter respectively, with a stroke of 39 in. All the cylinders are fitted with piston valves in place of ordinary slide valves, and the gear is an extremely simple modification of the type of gear now well known by the name "dynamic." All parts are of steel or phosphor bronze, and it is distinguished from all other gears by the very small number of its joints and parts.

All the cylinders are lined with hard liners and steam jacketed all round. Another important feature in the design of these engines is the unusually long main bearings, the principal ones being nearly two and a half diameters in length. The crank shaft is in three exactly similar sections, and each section is built, the pins being fine specimens of hollow-hammered steel forgings. The boilers are two in number, and are of Siemens-Martin mild steel. They are passed by Lloyd's to work a steam pressure of 160 lbs. per square inch, and have been tested satisfactorily to a pressure of 320 lbs. per square inch by hydraulic pressure. An unusual interest attaches to the launch of this vessel, as the engines are the first set of the Central Marine Engineering Company's type of triple expansion engines. The vessel will proceed shortly to the new eighty-ton sheers in front of the engine works to have her machinery fitted, and it is confidently anticipated that her trial trip at sea will show results of a highly satisfactory character. The christening ceremony was gracefully performed by Miss Winifred Baines, Bradgate, West Hartlepool, the vessel being named *Enfield*. The vessel has been superintended during construction by Captain T. Pyman on behalf of the owners.

Waikna.—On September 10th Messrs. R. Thompson & Sons launched from their Southwick Yard an auxiliary screw brigantine, named the *Waikna*. Her length is 104 ft., breadth 23 ft., depth of hold 8½ ft., and is built of steel to class 100 A1 at Lloyd's. She has a raking cutwater and neat round stern, is heavily sparred to give a large spread of canvas, and is fitted with lightning conductors to both masts. The cabin is very neatly fitted up aft under raised quarter-deck, with bathroom, &c.; accommodation is provided for the engineers in a house on deck, with a galley at fore end fitted with Brownlee's cooking range and condenser. The crew are berthed in forecastle, the fore end of which is intended for a large sailroom. The vessel has Clarke, Chapman & Co.'s patent windlass and capstan, Hastie's patent pillar steering gear aft, steam launch with compound surface-condensing engines, two lighthouses forward, teak skylights, and companion, &c. The engines are by Messrs. A. Shanks and Co., of Arbroath and London. The boiler, which is of novel construction, has a working pressure of 150 lbs. per square inch, and made by the Hazelton Boiler Company, of New York. The vessel has been built under the personal superintendence of Captain H. Ellis, who will also command her.

Torpedo Boat.—On September 12th there was launched on the Ribble a torpedo boat of new construction, built to the order of the British Government, by Mr. Richard Smith, shipbuilder, Preston, for the Indian service. The boat is intended for coast defences, and is adapted for working in very shallow water, her draught being only 2¼ ft. at a minimum speed of 15 miles per hour. She is built of best quality steel, ⅛ in. thick, galvanised. Her total length is 62 ft., beam 12 ft. and the mean depth amidships 4 ft., and will carry a crew of 16, with three tons of coal. The total weight of her hull is only five tons. She is fitted with high pressure engines, 8 in. by 9 in. stroke on each screw, and a locomotive boiler of large capacity, for maintaining steam to work up to 170 I.H.P. The machinery is equal to that of the best class of torpedo boat for coast defence. With engines, boiler, coals, and crew, the total weight will be 22 tons. The torpedoes will be shot from a spur in the bow.

Spenser.—On September 14th Messrs. Oswald, Mordaunt and Co., Southampton, launched a fine iron screw steamer of about 1,800 tons net register, and of the following dimensions:—Length, 323 ft. 6 in.; breadth, 38 ft. 6 in.; depth of hold, 26 ft. 9 in. The vessel has been built for Messrs. Lamport and Holt, of Liverpool. She is brigantine rigged, having pole masts of iron. Accommodation is provided for captain and officers in full poop; engineers and petty officers under bridge deck; crew and firemen under topgallant forecastle. She is fitted with Harfield's windlass, with capstan combined for working ship. Quartermaster steam steering gear amidships (Higginson's patent); screw gear aft; anchor crane on forecastle; four steam winches for working cargo. The engines and boilers are by the same firm; the engines being compound surface-condensing, with cylinders 34 in. and 70 in. diameter, with a stroke of 4 ft.; built crankshaft; steam and hydraulic reversing gear. Steam is generated by two large multitubular double-ended steel boilers, each having four furnaces, at a pressure of 100 lb. per square inch. The vessel has been built under the superintendence of Mr. John Russell. As the vessel left the ways she was named the *Spenser* by Miss Ella Oswald.

LAUNCHES—Scotch.

Steam-tug.—On August 12th Messrs. Hawthorns & Co., Leith, launched an iron screw steam-tug for the Metropolitan Board of Works, London. This is the second vessel of the same kind built by the firm for the same owners, and is intended for the Thames Fire Brigade Service. She measures 65 ft. long, 11 ft. broad, and 9 ft. deep, and has a draught of water of 6 ft. High pressure twin engines with 8 in. cylinders and 12 in. stroke are being supplied by the builders, and they are expected, as in the case of the former vessel, to develop a speed of about 12 miles an hour.

Elfin.—On August 15th a new steam yacht, named the *Elfin*, and measuring 35 ft. by 8 ft. by 4 ft. 3 in., was launched by Messrs. Marr Brothers, Leith, the owner being Mr. W. Strang, Edinburgh. She met with some damage in launching, but that was speedily repaired, and she was enabled to leave for Alloa in the afternoon on her trial trip.

Lu Sang.—On August 22nd the London and Glasgow Engineering and Iron Shipbuilding Company, Limited, launched from their yard at Govan a steel screw steamer, for coasting and river traffic in China, built to the order of the Indo-China Steam Navigation Company, Limited, of London. Her dimensions are:—Length between perpendiculars, 250 ft.; breadth of beam, 36 ft.; depth to main deck, 16 ft.; spar deck, 6 ft. 9 in. She is built to the highest class in Lloyd's registry, and of a gross tonnage of about 1,800 tons. Besides having extensive carrying facilities, she is fitted with first-class passenger accommodation suitable to the Company's trade. Great attention has been given to the ventilating and sanitary arrangements throughout the vessel, all being of the most modern and complete description. The vessel will be fitted by her builders with engines of the triple expansion type of the most approved description, and of about 180 N.H.P. On leaving the ways the vessel was named the *Lu Sang* by Mrs. Bolton, wife of Captain Bolton, the Indo-China Company's superintendent, under whose superintendence the vessel has been built.

Dundale.—On August 24th Messrs. Russell & Co., Port Glasgow, launched a finely-modelled iron sailing ship, barque-rigged, of 1,120 tons register, named the *Dundale*. She measures 216 ft. by 35 ft. by 21 ft., and is guaranteed to carry a deadweight cargo of 1,800 tons. She has been built to the order of Messrs. James Dunn & Sons, Glasgow.

Isabel Browne.—On August 26th Messrs. Russell & Co., shipbuilders, launched from their dock building yard at Port Glasgow an iron sailing ship of 1,500 tons nett register. The vessel, on leaving the ways, was named *Isabel Browne*, and is of the following dimensions:—Length, 230 ft.; breadth, 36 ft.; depth of hold, 21 ft. 6 in. She is built to the order of Messrs. Browne & Watson, Glasgow, will have a thorough East India outfit, and is intended to be engaged as a general trader.

Quarta.—On August 26th Messrs. Hawthorns & Co., Leith, launched from their yard an iron steam trawler named the *Quarta*, built to the order of Messrs. J. & L. Dossaer, Ostend. The dimensions are: Length, 100 ft.; breadth, 20 ft.; depth, 11 ft. The vessel will be supplied by the builders with engines 35 N.H.P., as well as all the latest improvements.

Lady Beatrice.—On August 27th Messrs. Ramage & Ferguson, Leith, launched from their yard an iron steam yacht, named the *Lady Beatrice*, built to the order of Captain Townley Parker, of Lancashire and London. The dimensions are: Length, 145 ft.; breadth, 22 ft.; depth, 13 ft. 6 in. She will be supplied with compound surface condensing engines, 18 in. by 36 in. by 24 in. stroke, having a working pressure of 85 lb. Mrs. Storey, London, performed the naming ceremony. After being fitted out the yacht will proceed on a two years' cruise round the world.

Clytie.—On August 27th the Grangemouth Dockyard Shipbuilding Company launched a sailing barquentine for the Falkland Islands trade, which was named the *Clytie* by the Countess of Zetland. The dimensions of the *Clytie* are:—Length, 140 ft.; breadth, 27 ft.; depth, 11 ft. 6 in.; deadweight, 500 tons; draught, 12 ft. Classed 100 A1 at Lloyd's by special survey.

Hokwei.—On August 27th Messrs. Blackwood & Gordon launched from their Castle Shipbuilding Yard, at Port Glasgow, an iron screw steamer, for passenger and general cargo service in Penang waters, of the following dimensions:—Length of keel and forerake, 170 ft.; breadth of beam, 25 ft.; depth of hold, 10 ft. 3 in.; tonnage gross, about 400 tons. Engines compound surface condensing, of 85 N.H.P. Diameter of cylinders, 22 in.

and 44 in. by 30 in. length of stroke, with large boiler capable of maintaining a working pressure of 90 lbs. per square inch. On deck are placed the steam windlass and steam winches, fitted with every appliance for the speedy working of anchors and cargo. Crew and firemen have accommodation in topgallant forecastle; captain, officers, and engineers in house under bridge; and accommodation for 16 first-class passengers has been placed in poop aft. This vessel has been built for Penang owners to the order of Messrs. John Buttery & Co., of London, and named the *Hokwei* by Miss Kerr, of Bath, and has been built under the inspection of Messrs. A. & R. M'Gechan, marine surveyors, Glasgow. After the launch the steamer was towed into the builders' dock to receive her machinery, which has also been constructed by her builders.

Dunrobin.—On August 27th there was launched from the shipbuilding yard of Messrs. Scott & Co., Bowling, an iron screw steamer of about 450 tons. This vessel has been built under special survey to class 100 A1 at Lloyd's, and is fitted with all the late improvements. Messrs. Muir & Houston, Glasgow, are to supply the machinery. The engines will have a N.H.P. of 75, with large boiler to work at 90 lbs. pressure. The vessel has been built to the order of Messrs. Smith, of Glasgow, and will be employed by them in the general coasting and home trades. This is the second vessel by Messrs. Scott & Co. for the same firm. On leaving the ways she was named the *Dunrobin* by Miss Smith, Ivy Lodge, Pollokshields. Mr. A. M. Taylor superintended her construction.

Steel Screw Steamer.—On August 27th Messrs. A. & J. Inglis launched from their shipbuilding yard at Pointhouse a steel screw steamer of 3,100 tons gross, her measurement being—Length between perpendiculars, 335 ft.; breadth (moulded), 40 ft.; and depth, moulded, 28 ft. The vessel is fitted with poop, bridge, and forecastle, and has accommodation in the poop for about 40 first-class passengers, and for a number of second-class passengers in the bridge-house amidships. She is rigged as a three-masted schooner, is fitted throughout with the electric light, has excellent loading and hydraulic gear, steam windlass and steam-steering gear, water ballast in double bottom, and is classed 100 A1 at Lloyd's. The engines, which are of the triple expansion type, will be fitted on board by the builders, by whom they have been constructed, and are expected to attain a N.H.P. of about 400.

General Gordon.—On Thursday, August 27th, Messrs. Alex. Stephen & Sons launched from their shipbuilding yard at Linthouse, a finely modelled steel screw steamer, of about 1,350 tons gross, built to the order of Messrs. Maclay & McIntyre, Glasgow, and intended for the Mediterranean and general trades. The vessel has been constructed of Siemens-Martin steel, under special survey of Lloyd's, to their highest class of 100 A1, and is built with a continuous cellular bottom for water ballast; has long raised quarter-deck; bridge house fitted up in a substantial and comfortable manner for the accommodation of captain, officers, and engineers; and topgallant forecastle for crew. The engines, also made by Messrs. Stephen and fitted on board before launching, are on the triple expansion principle, having cylinders 15 in., 24 in., and 40 in. diameter by 36 in. stroke, and will be supplied with steam from a steel boiler working at 160 lbs. pressure. As these triple expansion engines consume much less coal than the ordinary compound engines this secures the advantage of a saving in expenditure for fuel; and the difference in weight of coal for the whole voyage can be taken in increased dead weight of paying cargo. And the hull being of steel is itself lighter than an iron one, this difference also making an equivalent addition to the carrying capacity for dead weight of cargo. Increased earning capacity and reduced outlay thus combine to give this most modern type of steamer great advantages over the best of even recent vessels built of iron, and fitted with ordinary engines. Throughout the vessel embraces all the most recent and modern improvements for the economical working of the ship, and the rapid loading and discharging of cargo. On leaving the ways the vessel was named the *General Gordon*, by Miss Maclay, Williamwood, Grosshill.

Hyderabad.—On September 7th Messrs. Russell & Co launched from their Kingston Yard, Port Glasgow, a finely modelled iron sailing barque of 1,150 tons register, owned by Messrs. W. & J. Crawford, Greenock, and which was named *Hyderabad* by Mrs. Scott, wife of Captain Scott, late of the *Shalimar*. She is fitted with Messrs. Emerson, Walker, & Thompson Brothers, Limited, patent capstan windlass. The *Hyderabad* has been built to Lloyd's highest class, under the superintendence of Mr. Jas. M'Ewen; and, after fitting out, is to go to Glasgow to load on Messrs. Thomas Skinner & Co.'s berth for Yokohama.

Steam Fishing Vessel.—On September 8th Messrs. Mackenzie & Co., Leith, launched a steam fishing vessel, measuring 67 ft. by 17 ft. by 8 ft., and built to the order of Mr. James S. Cunliffe, Edinburgh. She is being supplied with engines by Messrs. Cran & Co., Leith.

Iron Screw Steamer.—On September 10th Messrs. Murdoch and Murray, Port Glasgow, launched an iron screw steamer, measuring 170 ft. by 23 ft. 6 in. by 14 ft. 6 in. She is a vessel of 504 tons gross register, with large hatches, iron decks, water ballast arrangements fore and aft, and every facility for the rapid loading and discharge of cargo. The machinery consists of a pair of compound engines having cylinders of 24 in. and 45 in. in diameter, respectively, with piston stroke of 30 in. After the launch the vessel was towed round to Ayr to receive her machinery, which is being supplied by Messrs. J. & T. Young, of that town.

Recorder.—On September 10th Messrs. R. Napier & Sons launched from their shipbuilding yard at Glasgow a steel cable steamer for the Eastern Extension (Australasia and China) Telegraph Company, London. This vessel, which has been specially designed by Mr. Joseph Birnie for laying and repairing the Company's submarine cables, is built of steel, to class 100 A at Lloyd's under special survey, and is of the following dimensions: Length, 230 ft.; breadth, 32 ft.; depth, 24 ft.; tonnage, 1,150. Externally the steamer, with a handsome cutwater bow, has the appearance of a Trinity yacht, while internally the arrangements are of the most complete character. Besides having the usual appliances of a modern merchant steamer the vessel is fitted with tanks for holding cables, &c., and has also been subdivided into 27 water-tight compartments for trimming and ballasting purposes. As the steamer is intended for service in hot climates, she has been built with an awning deck, and Messrs. M'Whirter and Roberts' steam ventilating apparatus has been fitted throughout the ship. Very complete accommodation for the officers and electricians has been provided aft, and for the petty officers and crew forward. The vessel will be lighted throughout by the electric light, a powerful search lamp being placed on the bridge for picking up buoys, &c. The cable gear is of the most modern design, and is driven by a pair of independent engines. It consists of combined hanging and picking up gear, with bow guards and picking up sheaves, whiskers, leads, &c., dynamometers for registering the pressure, steam and hand sounding machines; and the testing house is supplied with all manner of instruments for the work upon which the vessel will be engaged. The bow sheaves give the steamer a peculiar appearance, but they have been wrought into the design by the builders in an ingenious manner to form part of a cutwater stem, which adds to the symmetry of the ship, which is completed by a smart schooner rig. Compound surface-condensing engines, to obtain a speed of 12½ knots, have been constructed with all the most recent improvements, at the builders' Lancefield Works, under the supervision of Mr. Belsham, the Company's superintendent engineer, and when the vessel is completed she will be commanded by Captain G. Hales-Dutton, R.N. The word having been passed that all was ready, Mrs. Joseph Birnie cut the cord which held the launch, and named the vessel *Recorder*, and after seeing the ship safely afloat the company adjourned to the lunch-room where the usual toasts were duly honoured.

Corryvrechan.—On September 15th Messrs. Robert Duncan and Co. launched from their shipbuilding yard at Port Glasgow a finely-modelled steel sailing barque of 1,300 tons nett register. The vessel, which has been built to the order of Mr. Hugh Hogarth, shipowner, Ardrossan, is of the following dimensions: Length, 230 ft.; breadth, 36 ft.; and depth of hold, 21 ft. 6 in. She has been built to the highest class at Lloyd's, and has received a full East India outfit. She is a sister ship to the *Ochtertyre*, lately launched by the same firm for the same owners. On leaving the ways she was named the *Corryvrechan* by Miss A. Hogarth, daughter of the owner.

Eurasia.—On September 15th Messrs. Russell & Co., Greenock, launched an iron sailing ship of 1,900 tons nett register, classed 100 A1 at Lloyd's, and of the following dimensions:—Length, 262 ft.; breadth, 40 ft.; and depth, 24 ft. The vessel, which has been built to the order of Messrs. J. & W. Goffey, shipowners, of Liverpool, was, on leaving the ways, named the *Eurasia*, and is a sister ship to the *Malaysia*, recently built by Messrs. Russell & Co. for the same firm. The *Eurasia* is to be fitted out at Port Glasgow.

Steam Launch.—On September 18th there was launched from the shipbuilding yard of W. S. Cumming, Blackhill Dock, Monkland Canal, a steam launch, 55 ft. by 7 ft. by 4 ft. 8 in. moulded. This vessel is intended for patrol duty on the Suez Canal, and is suitably fitted up for this purpose. The hull is built entirely of steel, and all external woodwork, with exception of decks, is of teak. The steamer has been built to the order of Messrs. Ross and Duncan, and is being fitted by them with compound surface-condensing engines, having cylinders 7 in. and 13 in. diameter, working at a pressure of 150 lb. per square inch, and indicating about 60 H.P.

LAUNCHES—Irish.

Ierne.—On July 10th a twin screw steamer, called the *Ierne*, was launched by Messrs. Harland & Wolff, Queen's Island Shipbuilding Yard, Belfast. The *Ierne* has been built for the London and North Western Railway Company, to ply between Dublin and Holyhead. The launch took place in the presence of a select company, including Sir E. J. Harland, Bart., Mayor of Belfast, Admiral Dent, R.N., and Misses Dent, Mr. David Coates, and a large assemblage of the ordinary public. The christening ceremony was gracefully performed by Miss Ierne Dent. The *Ierne* is 300 ft. long, and is fitted up with all the latest and most approved apparatus and appliances, and will be propelled by two superior compound engines. The vessel, which is the first twin screw constructed for the Company, will be ready for the Dublin station in a few weeks.

Talookdar.—On August 22nd the *Talookdar*, a three-mast sailing vessel, was launched at Belfast, by Messrs. Harland & Wolff, for Messrs. T. & J. Brocklebank, of Liverpool. She is sister ship to the *Zemindar*, is 282 ft. long, with a beam of 39 ft. 6 in., and a depth of hold of 23 ft. 6 in. She is about 2,200 register tonnage, and is fitted up with all the latest improvements. She has winch and winch boiler for working the cargo. The steam could also be applied in case of necessity to the pumps. The windlass, which is one of Harfield's latest, is also worked by the winch, so that the anchors can be lifted by steam.

Glenavna Park.—On August 27th Mr. Paul Rodgers launched from his shipyard, at Carrickfergus, a steel barquentine, of about 600 tons deadweight carrying capacity, built to the order of Messrs. James W. Valentine & Co., Belfast. She is fitted with all the most modern and approved appliances, including Adair's patent treble chambered double actioned pumps, Emerson and Walker's patent combined capstan-windlass, Rodger's patent anchors, &c. Ample accommodation is provided in poop for captain and officers, and the crew will be berthed in a large iron deckhouse amidships. She has been built under special survey, and will be classed 100 A1 at Lloyd's, in addition to 20 years A1* red in Liverpool Underwriters' Registry, and is constructed considerably in excess of the requirements of both classifications. On leaving the ways the vessel was named *Glenavna Park*, by Mrs. Valentine, Glenavna, Belfast. The *Glenavna Park* is in every respect a sister ship to the *Linda Park*, launched at Ayr recently for the same owners.

LAUNCH—French.

La Bretagne.—The mail packet *La Bretagne*, left on her slip on the 12th of August, after a fruitless attempt at a launch, as will be remembered, was launched on the 9th of September from the shipbuilding yard of Penhoët. Immediately the dogshears were removed she glided swiftly without the help of the tugs, and her entry into the basin was effected without accident, notwithstanding a strong westerly wind which rendered this operation difficult, owing to the length of the boat and her light draught. The principal dimensions of *La Bretagne* are as follows:—Length, 155 metres; breadth, 15 m. 70; tonnage, 7,200 tons; H.P., 8,000. Her cables are 27-16 diameter, and she is fitted with a powerful direct steam combination capstan windlass, same as on board the *Champagne*, supplied by Emerson Walker and Thompson Bros., who, we understand, have also the order for the *Burgoyne* and *Gascoyne*, building at the Forges et Chantiers de la Mediterranean, La Seyne, near Toulon. She has, similar to the *Champagne*, launched on the 15th of May last, accommodation for 300 first-class and 900 third-class passengers. The *Champagne* and *La Bretagne* will be followed by the *Burgoyne* and *Gascoyne*, and will begin their service in the course of 1886.

TRIAL TRIPS.

Acorn.—On July 14th the *Acorn* (8), sloop, was taken outside Plymouth breakwater for a three hours' contractors' trial of her machinery. The engines of the *Acorn* have been made by Messrs. Maudslay, Sons, & Field, of London, and are on the compound principle, with surface condensers, &c. The engines are fitted with the velometer of Messrs. Durham, Churchill, & Co., of Leadenhall-street. The results of the trial were as follow:—Draught of water forward, 10 ft. 8 in., aft, 13 ft. 2 in.; steam in the boilers, when working on the highest grade of expansion, 70·7 lbs.; revolutions per minute, 78·2; effective pressure in H.P. cylinder 31·9 lbs., L.P. cylinder 11·11 lbs.; vacuum in condenser, 26·7 in.; indicated H.P. in H.P. cylinder, 365; in L.P. cylinder, 373; total, 728. An hour's trial was next made with the jet injection, and the results were as follow:—Steam, 60·5 lbs.: revolutions per minute, 82; pressure in cylinders—H.P. 31·6, L.P. 11·8 lbs.; vacuum in condenser, 25 in.; indicated H.P. in cylinders—H.P. 365, L.P. 403: total, 768. The engines were stopped from going full speed ahead in five seconds, and reversed to full speed astern in ten seconds; and from full speed astern to full speed ahead in five seconds.

Quinta Hermosa.—On August 11th the new screw steamer *Quinta Hermosa*, built by Messrs. John Fullerton & Co., Paisley, went down the Firth of Clyde for her official trial trip. She was built to the order of Marquis de Mouroy, of Caceres, Spain, for yachting and trading purposes, and is elegantly fitted up under the bridge with baths and all modern appliances. Messrs. Ross and Duncan, Glasgow, supplied the machinery, which worked admirably. The speed attained on the measured mile, on a mean of four runs, was 11¼ miles per hour, or 1¼ miles over the guaranteed speed.

Kyle.—On August 12th the steam hopper dredger *Kyle*, recently built for the Ayr Harbour Trustees, was subjected to a thorough test of her powers off Greenock. She has been built by Messrs. McKnight & Co., Ayr, and supplied with her machinery by Messrs. Fleming & Ferguson, Paisley. The *Kyle* has been designed for lifting about 1,500 tons of soil per day, and has a hopper amidships that is capable of containing about 500 tons. The trials began in a bank of sand and clay at a depth of 22 ft., and were afterwards continued at a depth of 30 ft. with the result that about 500 tons of material was thrown down the shoots in about three hours. She has two pairs of engines of 450 H.P., in addition to her propelling gear, and she can carry her dredgings out to sea at a speed of 9 miles per hour. Her entire cost was between £18,000 and £19,000. The trials gave every satisfaction to all concerned.

Raphael.—On August 18th this new screw steamer, built to the order of Mr. Frederick Bolton & Partners, of London, by Messrs. Joseph L. Thompson & Sons, of the North Sands Shipbuilding Yard, Sunderland, had her trial trip off the Northumberland coast. The engines have been built by Messrs. Thomas Richardson & Sons, of Hartlepool, and are of the compound surface condensing type. During the trial the engines worked with the utmost satisfaction.

Scout.—On August 20th the *Scout*, the first of the ocean-going torpedo cruisers building for the Admiralty by Messrs. James and George Thomson, of Clydebank, underwent her preliminary builders' trial, and the results attained were considered to be highly satisfactory by the Admiralty officers who were on board, one of whom was Mr. James Dunn, Chief Constructor. The speed realised was 17¾ knots per hour, while the power which was developed by the engines was greatly in excess of what was guaranteed in the contract. She is fitted with S. Baxter & Co.'s patent capstan fittings, the capstan being the latest type and fitted with a frictional brake similar to that on H.M.S. *Benbow*, &c., for veering cable and protection to the men at the bars.

Rosa.—On August 21st the new pilot schooner *Rosa*, which has been built by Messrs. Workman, Clark & Co., Limited, Belfast Shipyard, Belfast, for the Belfast Harbour Commissioners, went on her trial trip. She was towed down to Cultra, where sail was set for Bangor and after arriving there she reached across to Carrick. There was a good breeze, and with all sail set the *Rosa* went along splendidly, to the admiration of all on board. She steers well, is light on her helm, is quick in stays, and was pronounced to be a complete success.

Ban Whatt Hin.—On August 25th the *Ban Whatt Hin* (s), lately built and engined by Messrs. Blackwood & Gordon, Port Glasgow, for Messrs. E. Bowstead & Co., London, went down the Clyde on her official trial trip fully loaded, attaining a speed of 10½

knots at the Wemyss Bay measured mile, and generally giving great satisfaction to those interested. This steamer is 170 ft. by 25 ft. by 10 ft. 3 in., with compound surface-condensing engines of about 85 H.P., and carries 440 tons deadweight on 9 ft. 6 in. mean draught. The hull and machinery have been superintended during construction by Messrs. M'Nicoll & Co., Glasgow.

Esperança and Fé.—Two steam trawlers for Brazil, named the *Esperança* and *Fé*, lately had their trial trip. These vessels are built of steel, and their dimensions are 90 ft. long, 17 ft. beam, and 9 ft. deep; the tonnage (builders' measurement) is 115 tons. The machinery of the two vessels is precisely similar in arrangement, but the *Esperança* has considerably greater power than the *Fé*, as the former is required to do the work of carrying the fish from the fishing ground to Para, while the *Fé* will be usually employed at the fishing ground. To enable the fish to be kept in a marketable condition, even in the climate of northern Brazil, there is fitted in the engine-room of each vessel one of Lightfoot's vertical refrigerating machines, made by Messrs. Siebe, Gorman, and Co., London. The machine on the *Esperança* was tried, and it was found that the temperature in the fish-room was reduced from 60 deg. to 30 deg. in a few hours with an air pressure of 43 lb. per square inch. The *Esperança* is fitted with a pair of inverted engines, having cylinders 15 in. and 30 in. in diameter by 1 ft. 10 in. stroke, and a very large steel boiler having two furnaces. The *Fé* is fitted with similar engines, but having cylinders 13 in. and 26 in. in diameter by 1 ft. 6 in. stroke. The engines proved capable of driving the vessels 10½ and 9 knots respectively. The whole of the work connected with these vessels has been carried out by Messrs. Cochran & Co., of Birkenhead.

Pearl.—On September 3rd the screw steamer *Pearl*, recently built by Messrs. John Fullerton & Co., Paisley, had her official trial trip on the Clyde. She is a vessel measuring 170 ft. by 25 ft. by 12 ft., and is owned by Mr. William Robertson, Glasgow, by whom she is intended for the coasting trade. The engines, which are 70 N.H.P., having cylinders 22 in. and 42 in. in diameter respectively, with piston stroke of 30 in., were supplied by Messrs. William King & Co., Glasgow. She is fitted with the steam quarter-master steering gear, Higginson's patent. On the measured mile the *Pearl* made a speed of considerably over 11 knots per hour, and on the run between the Cumbrae and Cloch Lights she made a speed of 11½ knots.

Kathleen Mavourneen.—On September 5th this handsomely modelled steel paddle steamer, built and engined by Messrs. Jack & Co., Liverpool, for the Drogheda Steampacket Company, Limited, went on her official trial trip. Runs were made from the Bar ship to the North-west ship and back, and although the weather was very unfavourable (a stiff breeze blowing) a speed of over 15 knots per hour was obtained, while the heavy sea only served to bring out her excellent sea-going qualities. The *Kathleen* is a very handsomely modelled ship, built entirely of steel, and is a splendid addition to the company's fine fleet of steamers. She has been built under the special superintendence of Captain Laurence Branigan, the company's manager, and is fitted out with all the improvements suggested by his minute knowledge. Her engines are of the oscillating cylinder type compound surface condensing—H.P. cylinder, 47 in. diameter; L.P. cylinder, 85 in. diameter; stroke, 72 in. They are constructed in the best possible manner for regularity of speed and ease in stopping and starting. The H.P. piston is loaded, being equal in weight to the L.P. one, an advantage which any engineer can understand. Brown's steam and hydraulic reversing gear is fitted to the engines. Her circulating, air, feed, and bilge pumps are driven by a separate engine of the inverted cylinder compound type, and thus a regular vacuum is obtained in the condenser, the main engines driving the ship alone. A compound donkey pump is also fitted. The crank pin bearings are of patent metal, as are also the main bearings. Each cylinder has two piston rods. The boilers are of steel of extra large size, and in excess of the highest requirements of the Board of Trade. The boilers are fixed fore and aft, having in all twelve furnaces, and are intended to work at 85 lbs. pressure. Weir's patent hydrokineter is fitted to each boiler. The paddle-wheels are of small size and the floats are iron curved with angle irons on ends; very little back water is lifted by the wheels, owing to their construction, and they have proved a complete success. Chadburn's best engine-room reply telegraph is fitted; the steering gear is Harrison's steam steering gear; and the steam winches are by Clarke, Chapman & Gurney, Gateshead, and are of large size. Messrs. Emerson & Walker's, London, patent windlass is fitted; in fact everything necessary for the quick loading and discharge of cargo. She is for the cattle, cargo, and passenger trade between Drogheda and Liverpool, and for the cattle most complete ventilation has been provided. Her saloon is very large and handsome, and has accommodation for 52 first-class passengers. The whole ship is lighted by electricity, and is the first vessel of her class so fitted. This is the fifth ship owned by the Drogheda Steampacket Company. Her dimensions are:—Length, 270 ft.; breadth, 31 ft. 3 in.; depth, from top deck, 24 ft. 9 in.

Ariel.—On September 10th the steamship *Ariel*, built and engined by Messrs. Earle's Shipbuilding and Engineering Company, Limited, Hull, to the order of Mr. Edward Leetham, of the same town, was taken on her trial trip on the measured mile off Withernsea. The following are the dimensions of the vessel:—Length, 300 ft.; breadth, 42 ft.; depth of hold to top of floors, 20 ft. She is built of steel to class 100 A1 at Lloyd's, has a raised quarter-deck aft, long bridge amidships over engines and boilers, and topgallant forecastle forward, with turtle-back sides, and is generally adapted for carrying a large cargo on a moderate draft. Water ballast is provided under engines and boilers, and there is a deep tank in the main hold for water ballast or cargo. The saloon and state-rooms are fitted in a large iron house on the bridge, and the officers are berthed at sides of engine casing. The four steam winches are made by Earle's Company, three of them being of their special long-stroke compound type, and will be supplied with steam from a large donkey boiler, as well as from each of the main boilers. The vessel is also fitted with Messrs. Amos & Smith's patent steam-steering gear, and Messrs. Harfield's steam windlass. The engines are on the three-crank triple-compound system—*of which Messrs. Earle's Company have already turned out 15 sets, and have now eight sets in hand*—and have cylinders 23 in., 35 in., and 60 in. diameter, by a 57-in. stroke, made for a working pressure of 150 lbs. to the square inch. During the trial these worked most satisfactorily, indicating 1,470 H.P., and drove the ship at a speed of 12·24 knots.

Walter Scott.—On September 12th the *Walter Scott*, built by the Blyth Shipbuilding Company (Limited), of Blyth, to the order of Walter Scott, Esq., of Newscastle, had a highly successful trial trip. The vessel is built in accordance with Lloyd's rules for the 100 A1 class, and is of the following dimensions, viz.:—Length, 180 ft.; breadth, 29 ft.; depth moulded, 14 1-3 ft. Her deck appliances include Napier's windlass, steam winches by Messrs. J. Smith & Sons, of Newcastle, steam steering-gear by Mr. Beck, of Sheffield, and compasses by Mr. James Wood, of Blyth. She is constructed with cellular bottom, and her deck arrangements are topgallant forecastle, and short bridge and break aft under which is the saloon, captain's cabin, &c. Very large trimming hatches are provided so that in loading the trimming charges will be reduced to a minimum. The engines are compound surface condensing, and have been fitted by Messrs. Thos. Clark & Co., of Newcastle, and gave most satisfactory results during the trial. A large party of ladies and gentlemen, numbering about 50, including the owner, the shipbuilders, engine builders, &c., joined the vessel off the Tyne. After having had a trial of speed, the company set down to an excellent luncheon provided by Mr. Gibson, of the Douglass Hotel, Newcastle. The steamer left for Hartlepool the same evening to load for London, on which station she will run, carrying the coal from the East Hetton and Trimden Grange Collieries, under the management of Mr. W. B. Porter, Hartlepool. Both Hull and engines have been built and completed under the superintendence of Mr. Wm. Menzies, consulting engineer of the firm of Messrs. Menzies and Blagburn, of Newcastle and London. The *Walter Scott* is commanded by Captain Walton.

Shieldrake.—On September 14th the steamship *Shieldrake*, built at Dundee by Mr. W. Thompson, of Glasgow and Dundee, made a steam trial outside the river Tay, when very satisfactory results were obtained. The *Shieldrake*, which has been built of steel for the Cork Steamship Company, is of the following dimensions: 250 ft. by 32 ft. by 15 ft. 8 in., with compound surface-condensing engines of 160 N.H.P.; cylinders, 29 in. and 37 in.; stroke, 48 in.; steam being supplied from a double-ended steel boiler, at a pressure of 90 lbs., engines and boilers being made at Mr. Thompson's Tay foundry, and she is fitted with the steam quarter-master, Higginson's patent. Leaving Dundee in the forenoon, the steamer made direct for the Bell Rock, where the *Ferdinand Brum*, a Swedish barque, timber laden, had stranded the previous day. On arriving close to the rock, Mr. Thompson and Mr. Anderson, his manager in the Caledon Shipyard, who were both on the steamer, boarded the stranded barque—the weather being favourable—and from the examination they made came to the conclusion that the vessel might be towed off at high

water. The *Shieldrake* was then put about for the Buoy-of-Tay, and from that point ran to the Beacon at the Carr, doing the distance at a speed of 12·7 knots per hour. On the return run from the Carr to the Buoy-of-Tay, against the tide, the speed observed was 12·27 knots, giving a mean speed of about 12½ knots, during which the engines indicated 1,326 H.P., at 78 revolutions per minute. On reaching the Buoy-of-Tay on the northward run, the *Shieldrake* made again for the Bell Rock, which was reached shortly before flood tide. By this time the stranded vessel appeared to be afloat, and a boat containing Mr. Anderson and some of the hands put off from the steamer, and were soon aboard the wreck, from which a hawser was passed on to the steamer, and a little before sundown the barque was successfully towed off the rock. It was now found that the chains, having fallen through the broken bottom, were dragging, and until these were cut little progress could be made in towing; accordingly the *Shieldrake* stood by the barque all night, and at daylight a number of men under Mr. Anderson boarded the derelict and cut both cables. Towing was then resumed, but as the wreck had a heavy list to port, and floated only on her cargo, which consisted of pitch pine logs, and a strong breeze prevailing, very little progress was made. About nine o'clock the tug, *Iron King*, came up, and an agreement being entered into for her assistance, good progress was made in the direction of the river mouth. When about half way to the Buoy-of-Tay the wind came away with increasing force from the south, and the services of a second tug, which by this time had appeared, were likewise secured, and later on a third tug appearing was also engaged, and with the *Shieldrake*, and the three tugs towing, a good speed was obtained, and during the course of the afternoon the barque was successfully beached in the West Ferry Bay, about three miles below Dundee. The vessel had suffered damage to such an extent that repairs will probably be considered impossible, but the salvage of her cargo, valued at about 2,500*l*., will form a good prize to those who took part in the work.

Ho Kwei.—On September 19th the iron screw steamer *Ho Kwei*, built and engined by Messrs. Blackwood & Gordon, Port Glasgow, proceeded down the Firth on her official trial trip, the weather being extremely unfavourable on account of the strong wind and heavy sea in the channel. The trial runs for speed were tested on the measured distance in the Gareloch, when a speed of fully 10½ knots was attained on a consumption of about 7½ tons per 24 hours. The dimensions of the steamer are as follow, viz.:—Length of keel and forerake, 170 ft.; breadth of beam, 25 ft.; depth of hold, 10½ ft.; gross tonnage, about 400 tons. Her engines are compound surface-condensing. The diameter of cylinders are 22 in. and 44 in. by 30 in. stroke; 85 N.H.P.; boiler, 80lbs working pressure; deadweight carrying capacity on 9 ft. 6 in. mean draught, 440 tons. The steamer is fitted with steam windlass, steam winches, and donkey boiler, and every requisite for the expeditious loading and discharging of cargo, and her main bridge and forecastle decks are laid with teak wood. In the poop aft accommodation is provided for 16 first-class passengers; midships' accommodation is fitted up in teak deck for captain, officers, and engineers; and in topgallant forecastle accommodation for crew and firemen is provided. On midship bridge a teak chart-house is fitted up for the use of the captain; and underneath two large boilers, with connection from main boilers, to cook by steam for 250 native passengers, are provided. This steamer has been built to the order of Messrs. John Buttery & Co., of London, on account of Penang owners, and is intended for the general passenger and cargo trades in the States Settlements. She has been built and fitted out under the direct superintendence of Messrs. A. and R. M'Gechan, marine surveyors, Glasgow, and leaves for Penang, under the command of Captain Richard Skinner.

Mararoa.—On September 22nd the trial trip of the *Mararoa* (s) took place. The *Mararoa* sailed to Lamlash Bay, and rounding the Holy Island returned to Roseneath Point, whence she started. The weather was fine and the trip enjoyable. The *Mararoa* has been built by Messrs. William Denny and Brothers, Dumbarton, and engined by Messrs. Denny and Co., of the same town, for the Union Steamship Company of New Zealand, Limited. Her principal dimensions are:—Length, 320 ft.; breadth, 42 ft.; and depth moulded, 26 ft.; gross tonnage, 2,600. Above the upper deck is a promenade extending over three-fourths of the length of the ship, and sheltered by a roof deck extending over the length of the engine room and boiler spaces. She is constructed of steel according to Lloyd's rules for the 100 A1 three-deck class, having a full poop, midship houses, and topgallant forecastle, straight stem, and elliptical stern. The vessel is rigged as a two-masted schooner, square rigged on the foremast. She has a double bottom on the cellular system, extending from peak bulkhead to peak bulkhead—except under the boilers, where the ordinary floors are fitted—capable of containing 300 tons of water ballast. The double bottom is carried into separated compartments, and is so arranged that each of them may be filled and emptied independently. The engines are direct-acting and surface-condensing on the triple expansion principle, having three cylinders—one low pressure, one intermediate, and one high pressure. The diameters of the cylinders are 84 in., 51 in., and 31 in. respectively, with a stroke of 4 ft. 6 in., giving an I.H.P. of 3,600. Steam is raised by two double-ended steel boilers, having 12 of Fox's corrugated furnaces. The working pressure obtained is 160 lbs. per square inch. The vessel will carry 150 first-class and 120 second-class passengers. She is to be engaged in the New Zealand home trade, and will be commanded by Captain Eadie. She is up to all the Admiralty requirements and fitted for Government service, being divided by eight tranverse bulkheads, five of which are watertight and extend up to the upper deck. The carrying capabilities of the ship are 2,200 tons. She is fitted with hydraulic gear for loading and discharging cargo, lowering and hoisting her boats. She will have ample stability under ordinary conditions of loading even without the water ballast. The vessel is fitted throughout with electric lights, and has patent ventilators.

Mananense.—On September 23rd the trial trip took place of the *Mananense*, one of the steamers of the Red Cross Line, owned by Messrs. Robert Singlehurst & Co., of Liverpool. The *Mananense* was built at Glasgow close upon 12 years ago, and was supplied with compound engines, her nett tonnage at that time being about 800 tons. Recently the vessel has been undergoing extensive alterations, rendered necessary more particularly on account of the engines with which she was then fitted not being adapted to her requirements. By conversion of the engines to triple expansion and the substitution of new boilers of Siemen's steel, capable of working at a pressure of 150 lbs. to the square inch, work which has been carried out by Messrs. David Rollo and Sons, of Foulton Engine Works, under the direction of Mr. George Hepburn, consulting engineers and Mr. William Isaacs, marine superintendent of the company, some 200 or 300 tons extra cargo space has been obtained, for the old engines had the additional drawbacks of needing considerably more fuel. There are four cylinders on the engines—two high pressure, 17 in. in diameter; one intermediate, 38 in.; and one low pressure, 60 in., having a stroke of 3 ft. 6 in. The high pressure cylinders are worked by piston valves, the intermediate cylinder is fitted with Church's patent slide valve, and the low pressure one with Thom's slide valve. The glands have been packed with Roger's metallic packing throughout. The vessel proceeded down the river, going a few miles beyond the Bar Lightship, numerous counts being subsequently made of the time she took to accomplish the measured mile. The engines worked surprisingly smooth at 74 revolutions per minute, and the vessel attained an average speed of 13 knots per hour on the measured mile.

Decline in Shipbuilding.—The report of the Registrar-General of Shipping and Seamen states that in the month of August there were added to the registers of the United Kingdom and the Colonies 114 vessels, the net register tonnage of which was 38,974. In the same time the number of vessels removed from the registry was 166, the net tonnage being 37,915. Out of the vessels added only thirty-six were steamers, and many of these were of small dimensions, for river or special service—five iron steamers being added to the register for the United Kingdom of less than 100 tons each, while all the wooden steamers added to the United Kingdom register were less than 20 tons each. The chief addition to the tonnage last month was in the iron sailing vessels—fifteen being added to the register for the United Kingdom, of the net registered tonnage of 19,787. All the wooden sailing vessels added to the United Kingdom register last month were of small dimensions, with one exception, twenty-four ships being below 100 tons net register, and only one above that tonnage. Similar remarks apply to the colonial registers, so that it would seem that there are now very few large vessels being built, and that the building carried on is of vessels for special trades and uses. On the other hand, the loss of vessels is more varied, the iron steamers removed from the registry being fourteen, of a net tonnage of 9,485. Taking both home and colonial registers, the horse-power of the vessels added last month was 2,708, and that of the vessels removed was 3,158, so that the effective carrying power is being reduced.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

THE POSITION OF MARINE ENGINEERS.

To the Editor of The Marine Engineer.

Sir,—I have read with interest the letters appearing under the above heading, for some time past, in The Marine Engineer. Your different correspondents have handled the subject remarkably well, and I trust you will allow me space for a few remarks. It is a matter intimately affecting every sea-going engineer, and one which it is to be hoped, now that it has been so well threshed out in your columns, will be warmly taken up, and not dropped until some restriction is put upon the manner in which this trade has been imposed upon.

The different grievances under which marine engineers labour may be placed under three heads—1st. The qualification necessary for the position of marine engineer. 2nd. The engineer's position as regards the captain, and the food provided where they are found. 3rd. The accommodation provided for engineers.

The first is a most important matter, hedged round by Board of Trade regulations, all of which have, apparently, the object of having none but competent men as engineers, but still some of their provisions are so lax that any person, in fact, can, after four years' service in the engine-room, obtain a Board of Trade certificate of competency as an engineer; and thus we have men who never served an hour at the trade—viz., firemen, pattern-makers, and turners, &c., in charge of marine engines; and captains are actually to be found with certificates in steam—men who, if they were placed in an engine room, could not, were it to save their lives, start or stop the engines; their certificates being obtained on set questions and answers, which they have learned as a parrot would, having no knowledge whatever of what they were talking about. A man to fill the position of engineer in a steamship should be a practical tradesman who has served five years as an engine fitter at the making and repairing of marine engines, he should have a good education, and a knowledge of the theory of the steam engine. To send a man to sea in a ship, who is not a tradesman, is certainly endangering the ship and all in her; he may be able to start or stop the engines but there his knowledge ceases, he is not fit to use tools in case of repair or breakdown, and it is degrading to the trade that such men should be allowed to hold such positions.

I agree with some of your correspondents that it is time the Board of Trade took this matter into their consideration, they are all practical men who have an intimate knowledge of a marine engineer's position, and I believe if the matter was placed fairly before them that a change would be made; to let, no person enter for a certificate of competency who cannot produce discharges of having served for five years as an engine fitter at marine engines, and also lower the power to—say 70 H.P., above which in all vessels the chief engineer must have a certificate. This would prove an effectual barrier to shovels.

I am myself, and I know several others, prepared to attach their names to a memorial to the Board of Trade to this effect; and I have no doubt but that every practical engineer would sign it, and that it would receive serious consideration.

2nd.—As regards the engineer's position in reference to the captain, a source of great annoyance and persecution to engineers comes under consideration. The captain certainly is supreme in command of the ship, and the engineers are bound to obey his orders; yet still in regard to him the engineers first feel the Board of Trade rules. The keys of the safety valves are placed in his keeping, which certainly means a want of confidence in the engineers, and he invariably is the person that wants high speed, particularly in passenger vessels; coals are no object so long as a good speed is maintained, and in order to pass other vessels instances are known where they proposed to the engineer to put extra pressure on the safety valves to accomplish their object. Captains should remember that engineers, with few exceptions, are their equals by education, and that they are entitled to be treated with decency. They obtain their certificates by an examination on what is certainly a far more intricate and difficult subject than navigation. If anything occurs in a steamship, the captain generally sends for the chief engineer, and still it appears to be the opinion of captains that engineers are a necessary evil. If captains would give the matter a little serious thought, I have no doubt but that they would have a little more consideration for their engineers; and the ship, instead of being a place of torture, would be a home for all concerned. Another matter in which the captains are interested is the food question. In ships where the engineers are found many cases occur where bad food is sent to the engineers and a totally different class provided for the cabin; surely this matter cries for immediate remedy. It would be well for engineers if steamship owners were to find the ship's stores, and not leave it in the captain's hands; a source of annoyance would be taken away, and a better feeling brought about.

3rd.—Then to the accommodation provided for engineers. This appears to be little thought of; any corner a berth can be put into appears to be good enough for an engineer. There is no thought given to their comfort; and who in the ship requires it more? What will conduce to their doing their duty more than to have a comfortable room, and if possible a bath when coming off watch, where they can be rested and ready for their next watch. In the majority of ships all comfort in this respect falls to the captain; he has his state-room, bath-room, &c., in the cabin, and another room on the bridge, all luxuriously furnished, while the engineers are put into any place. In some of our cross-Channel steamers of upwards of 1,500 I.H.P., particularly paddle vessels, they are put out off the ship altogether: their rooms are on the sponsons, where when there is a slight sea sleep is impossible, and their rooms are generally so damp that they can keep nothing in them. Yet they are the persons on whom the keeping down the expenses of the ship rests, for to the engines and boilers the great part of the expenditure is attached, and if they are comfortable an inducement would be held out to them to keep everything in good order and expenses down.

Before closing I would like to make a few remarks on "An Old Chief's" letter in your September issue. He belittles the question of men who are not engine-fitters being appointed engineers, and he then speaks of engineers having a habit of speaking ill of men who have preceded them. Surely he does not mean to say that they should not give a true report of the state of the machinery? and if it is in a bad state, who is to blame but the incompetent person who left the ship, and who may possibly have been a shovel; if he had been an engineer the machinery would not have been in such a state, and no person could have given an unfavourable report. Surely "An Old Chief" is not a practical engineer when he makes such suggestions. Would we have "proper self-respect" if, after joining a ship, we sent in a lying report on the machinery? No doubt some of our number are dissipated, but there are black sheep in every flock, and they only serve to make more prominent the men who conduct themselves properly. But these men are few, and where will they be kept when once it is known that they were drunk on watch?

I earnestly trust that this discussion in your journal will have a good effect all round. Apologising for trespassing so far on your valuable space, and thanking you in anticipation for inserting this letter,

I am, yours truly,

A MARINE ENGINEER.

Liverpool, *8th September*, 1885.

The *Scout*, torpedo cruiser, lately completed her steam trials at Portsmouth by a four hours' full power run under forced draught. The trim of the ship was 10 ft. 4 in. and 14 ft., forward and aft respectively. The mean pressure in the boilers was 113 pounds, the average revolutions of the engines being 152 in both cases. The H.P. developed was 1,681·41, and 1,670·51 by the starboard and port engines, giving a collective power of 3,352 or 152 horses in excess of the contract. The speed realised was $17\frac{1}{2}$ knots. Mr. Bakewell watched the trial on behalf of the Admiralty. The completion of the *Scout* will now be pressed forward. She will carry four 5-inch guns, and will be fitted with 11 shoots for discharging Whitehead torpedoes.

The United States Navy.—The steel war-vessel *Dolphin*, built by Messrs. Roach & Sons for the United States Navy, which broke her steel shaft on a trial trip in November up the Sound, has had another shaft forged and put in, and another trial trip will soon take place. The *Dolphin* must develop a speed of 15 knots per hour under the existing contract. The new shaft is of wrought iron, 12 in. diameter, 2 in. thicker than the steel shaft.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from August 21st to September 21st, 1885.

9920 J. Lyle. Steam steering gear.
9928 W. L. Collamore & W. Ackroyd. Engine governors.
9939 Clark (A. Chauvel). Life saving sheet.
9946 Clark (J. E. E. Fromentin). Feed water apparatus for steam boilers.
9953 J. M. Bunting & J. T. Findlay. Oil cans.
9954 R. W. Thomas. Ball cock.
9955 W. Wilkinson. Air condensers.
9960 S. W. Wiles. Marine steam generators.
9961 J. Waddington. Screw propeller and steering gear applicable to steam ships.
9967 B. Wicksteed. Tube beaders.
9968 J. C. Bauer. Feed steam boilers.
9969 J. Dillon. Means for taking hydrographic soundings.
9971 J. J. Royle. Generating steam.
9973 H. Dimancea. Small arms.
9974 J. F. Swinburne. Drop down small arms.
9975 J. C. Scott. Gun wads.
9986 J. Richards. Devices for use with machine guns.
10007 H. Wilson. Low water alarms for steam boilers.
10008 Abel (A. C. Nagel, R. H. Kaemp, & A. Linnenbrügge). Centrifugal pumps.
10019 J. S. Raworth. Indicating apparatus for navigable vessels.
10020 W. Malam. Steam boilers.
10044 W. Dodshon. Prevention of sea sickness.
10067 J. D. Jack. Steering gear for fishing boats.
10069 Redfern (L. T. Froideville). Floating breakwaters.
10079 W. S. Parkes. Hauling grips.
10083 J. Storer. Furnaces.
10106 R. W. Studdy. Firearms.
10112 A. Reis. Apparatus for producing a draught.
10117 W. Speight. Hydraulic engines.
10125 H. Trott. Valves.
10141 D. Campbell. Steering engines.
10145 W. Burnett. Guns.
10148 J. J. Royle. Steam traps.
10170 D. MacQueen. Pump buckets.
10177 Boult (W. W. St. John). Valve gear.
10188 A. Anderson & H. C. Paterson. Furnaces.
10213 A. Feist. Swing joints for pipes containing steam.
10217 J. Matthews. Compound expansive steam engines.
10219 J. J. Defalque. Metallic packing for stuffing boxes.
10227 W. D. & J. Priestman. Construction and working of motor engines.
10244 E. Mansfield & W. Gadd. Holding and delivering gas on board ship.
10251 E. Davies. Self-acting cut-off pressure valves.
10270 A. Budenberg. Pressure and vacuum gauges.
10274 D. H. Willey. Breechloading guns.
10282 T. W. Beverley. Blowing, ventilating, and exhausting.
10283 W. Muir & D. C. Smith. Gas motor engines.
10287 C. Armstrong & R. N. Tough. Vessels.
10290 F. E. P. Ehrlich. Valves.
10305 J. F. F. Common. Means of protecting paddle shafts.
10308 E. G. C. Bomford. War ships.
10310 W. J. Brewer. Reducing friction.
10312 R. Marshall & G. H. A. Thunder. Pump valves.
10315 Lake (W. H. Brown). Gun barrels.
10317 Imray (H. Bischoff & A. Mieg). Case projectiles.
10318 Imray (H. Bischoff & A. Mieg). Constructing case projectiles with guiding collars.
10320 W. Zealand. Screw or twin screws for propelling sailing vessels.
10321 Mills (G. Serramoglia). Ventilators.
10323 F. M. Roots. Pistons of rotary pumps.
10327 G. M. Marchant. Taps and valves.
10337 J. H. P. Johnstone. Life saving apparatus.
10344 J. Rowbotham. Water meters.
10348 J. Snowdon. Supply of lubricating material to steam engines.
10353 A. Turnbull. Safety valves.
10363 C. W. Hayes & C. C. Duncanson. Projectiles.
10394 J. C. Threadgold. Propelling and steering torpedoes.
10396 H. M. Bennett. Communicating with the crews of ship-wrecked vessels.
10397 Veasey (J. H. Lancaster). Automatic boiler tube cleaners.
10404 Downing (A. Quernel). Compound steam engines.
10405 J. Fielding. Hydraulic motors.
10409 Gardner (D. Lublinski). Compound to prevent rust.
10417 H. S. Dunn & G. F. Loudon. Water gauges or indicators for steam boilers.
10419 G. J. Scott. Galloway tubes.
10423 A. Roberts. Preventing and removing incrustation in boilers.
10437 H. Stokes. Ships and boats.
10443 J. J. Tylor. Liquid meters.
10464 J. Stuart & J. Graham. Facilitate the riveting of iron or steel ships.
10465 C. Perks. Solving problems in navigation.
10470 M. Selig. Submarine mines.
10472 J. Pearce. Speed indicator.
10478 T. Cheadle. Alarm guns.
10514 E. G. Wood. Ventilators.
10520 J. Webster. Closing the feed hole of oil cans.
10536 I. Joseph. Reading the indications of the mercurial column in barometers.
10537 J. Walshaw. Generating steam.
10542 W. R. Lodge & J. Holmes. Mooring breakwaters.
10545 C. Lawrence. Ventilating the stokeholes of furnace rooms.
10564 T. H. Williams. Feeding fires and furnaces with fuel.
10573 G. Murray & R. Turnley. Pump.
10578 H. N. Crellin. Propulsion of ships and other vessels.
10580 F. Girein. Propulsion of ships.
10583 J. Harrison. Steam boilers.
10596 F. Hocking. Packing for stuffing boxes.
10615 Reed (T. Barber). Boiler feed and alarm.
10619 C. E. Smith. Corrugated boiler furnaces, or flues and pipes.
10624 A. Gilchrist & R. Smith. Compressors or holders for hawsers for ships' use.
10626 Thompson (F. H. Bolte). Lubricators.
10627 Thompson (W. J. Muncaster & M. McKaig). Machine for boring, dressing, and finishing engine cylinders.
10630 Imray (C. Richard). Steam trap.
10634 Yate (La Société Anonyme de Constructions mecaniques d'Anzin). Valve and valve gear.
10642 Edwards (E. Rothe). Centrifugal machines.
10647 Sears (W. Hadden). Apparatus for stopping ships and vessels.
10648 J. B. Cooper. Stationary boiler flues for economising fuel and consumption of smoke.
10655 Wise (J. Marquart). Furnaces.
10657 F. B. Dœring. Evaporating sea water, nitrate, or other solutions or liquids.
10663 Edwards (E. Fourcault & E. Jacques). Regenerative hot air furnaces.
10664 R. Paulson. Breechloading and repeating firearms.
10674 J. Taylor. Navigable dredging vessels.
10676 W. Stevens. Apparatus for regulating and controlling the cut-off of steam and other pressure engines.
10677 H. Carrière. Self oil feeder.
10694 A. McNab. Apparatus for condensing exhaust steam of steam engines, and heating feed water for steam generators.
10695 F. C. Guilleaume. Packing for pipe and other joints.
10698 C. Cochrane. Working of blast furnaces.
10699 F. W. Brewster. Buoyant garments.
10719 J. Cran & W. J. Darling. Steam generators.
10722 L. George. Boats' rowlocks.
10730 A. Beldam. Metallic valves.
10745 W. Burns. Self-acting feed apparatus for steam boilers.
10764 H. C. Paterson & R. Miller. Steam boiler and other furnaces.
10798 H. W. Jones. Submerging vessels.
10821 Fairweather (Milton, W. Hazelton and the Babcock and Wilcox Co.). Feed water heaters and purifiers.
10826 O. J. Ellis. Expansion or cut-off valves for steam engines.
10848 A. Horne. Valves.
10859 G. Correll. Lubricator.
10865 W. H. Daniels. Tube motor for propelling vessels.
10869 W. H. Daniels. Paddle wheels.
10874 J. Stephens & A. Smith. Supplying steam boilers with water.

10887 T. & W. Toward & J. Meek. Steam generators.
10894 V. N. Cowburn & A. Johnson. Safety valve apparatus.
10921 A. C. Calmour. Preventing sea sickness.
10923 G. B. Hingley & J. R. Curry. Anchors.
10925 W. Lowrie. High speed engines.
10948 Lake (A. Bangano). Cable.
10963 T. Wolstenholme & C. Gaul. Pumps.
10967 C. C. Mills. Mechanically feeding fuel.
10974 J. Miller. Injectors.
10980 W. M. Bullivant. Torpedo nets.
10983 H. J. Haddan (M. Lindner). Lubricating journals.
16985 A. M. Wood. Construction of ships.
16986 J. M. McMurtrie. Lubricators.
10998 C. H. Murray. Opening the breach of heavy guns.
11009 A. Allan. Pressure gauges.
11026 G. O. Grace. Compensation of chronometer errors.
11036 A. Pople & R. M. Bryant. Preventing incrustation in boilers.
11042 A. Macmillan. Slide valves.
11046 H. C. Turner. Furnace door fastenings.
11063 J. Lang. Towing apparatus.
11064 W. C. Johnson & S. C. Phillips. Submarine cables.
11080 J. Beveridge. Propelling and steering vessels.
11087 J. H. McGuire. High speed rotary engine.
11088 G. Bridge. Lubricators.
11102 F. Lake. Electric communication from light ships, etc., to shore.
11105 H. Gillespie. Boats.
11114 G. Greig. Ventilation.
11118 J. Holcroft. Using superheated steam.
11122 B. Dickinson. Screw propellers.
11127 J. F. L. Crosland. Joining metal plates.
11132 D. McDermid. Propelling paddle steamers.
11143 J. Patterson & M. Sandison. Forced draught to furnaces.
11144 W. F. Perman. Valve gear.
11147 J. Aimers. Governors.
11148 J. Belliss. Motor.
11172 T. Nordenfelt. Machine gun.
11173 T. Nordenfelt. Gun carriages.
11193 T. C. Hide & W. Wardrop. Quick speed triple, etc., expansion engines.
11194 W. Rawson. Protecting shields for vessels in collision.
11196 L. E. Liardet. Rudder fittings.
11211 A. Waly. Steam signalling.
11217 T. Nordenfelt. Machine gun.
11218 J. Vavasseur. Controlling recoil of ordnance.
11223 H. B. Merton. Compound steam engine.

It is said that a new substance for ships' armour has been satisfactorily tried. It is obtained from cocoanut cellulose, and has the property, when penetrated by shot and shell, or even after the explosion of a torpedo, of closing up as rapidly as it has been perforated, and thus preventing the influx of water into the ship's hold. Some important experiments have lately been made with the composition before a French commission at Toulon. The commission submitted the composition to a three-fold test—against shot, shell, and torpedo. The target was a cofferdam made of a mixture of fourteen parts of pulverised cellulose and one part of cellulose in fibre. This composition was compressed to a felt-like mass, of which one cubic metre weighed 120 kilogrammes, or one cubic foot, about 8 lb. A layer of beams 4¾ in. thick represented the side of the ship, behind which there was a layer of the new material 2 ft. thick. Against this target a 7½ in. solid shot was fired, which penetrated it, taking with it not quite one-fifth of a cubic foot of composition—a very small quantity, considering the size of the shot. But as soon as the shot had passed through the target the cellulose composition closed up again, and so firmly that a strong man was unable to force his arm through the opening made. A box filled with water was then fixed against the aperture, the contents of which ought to have acted in the same way as if the cofferdam had been washed by the sea. It was observed that a few drops of water began to percolate after the lapse of from ten to fifteen minutes, and even after the composition had become well saturated with water only between three and five pints of water escaped per minute, which could be easily intercepted by pails. As soon as the cellulose had become thoroughly soaked and grown denser, it offered greater resistance to the percolation of water, which finally almost ceased to flow.

BOARD OF TRADE EXAMINATIONS.

Note.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

August 22nd, 1885.

Arnett, Robert .. 2C Glasgow
Balloch, J. L., E1C Leith
Bjorch, Kark J.. 2C Sunderlnd
Boiss, George C. 2C London
Brotherton, J. G. 1C Sunderlnd
Crane, Alex. .... 1C Aberdeen
Crathorne, Robt. 2C Sunderlnd
Deam, John .... 2C Liverpool
Doughty, H.... 1C Hull
Dunn, Artemus.. 2C Cardiff
Elder, James.... 1C Sunderlnd
Escott, Wm. G. 1C London
Fisher, Frank .. 1C Liverpool
Gear, Arthur J.. 2C Cardiff
George, James .. 2C ,,
Gibson, James B. 2C Liverpool
Gill, John ...... 2C Sunderlnd
Glass, J. H. .... 1C Southamt
Goodall, W. G.. 2C ,,
Green, Henry .. 2C Liverpool
Greenhalgh, Wm. 2C Sunderlnd
Hamilton, Alex. 2C Glasgow
Herington, G. H. 2C London
Jackson, Tom .. 1C Hull
Johnson, Henry 2C London
Kaye, Arthur W. 1C ,,
Kellett, Robt. M. 2C Sunderlnd
Lister, Alex. M. 1C Liverpool
McHugh, Patrick 2C N Shields
Morgan, Ed. A. 1C Cardiff
Neville, Henry.. 2C Liverpool
Phenna, John H. 2C ,,
Robb, Wm. .... 1C Cardiff
Roberts, Ed. A. 1C Liverpool
Sim, George .... 2C Aberdeen
Smith, R. S..... 1C N Shields
Strachan, John.. 2C Dundee
Stratford, Wm.. 1C Liverpool
Thomas, Walter 1C Cardiff
Tomlin, Thomas 1C Liverpool
Turner, Wm. C. 2C Sunderlnd
Tyler, John .... 1C Cardiff
Watson, John .. 1C Sunderlnd
Winterburn, F.C. 2C N Shields
Yates, John .... 2C ,,

August 29th, 1885.

Adam, W....... 1C Glasgow
Allan, A. ...... 1C ,,
Gourlay, Robert 2C ,,
Keladete, N..... 2C London
Lesnzor, D. J. .. 2C Glasgow
Moon, Wm. J... 2C ,,
Perivancich, Jno. 1C ,,
Pugh, Wm. W.. 2C Liverpool
Pullin, J. F. P.. 2C London
Richardson, A... 1C Glasgow
Thomson, A..... 2C ,,
Thorp, Robert .. 2C London
Webster, H. .. 1C Leith

September 5th, 1885.

Alexander, Wm. 2C Leith
Annan, Jonathan 2C Glasgow
Bones, Edward.. 2C N Shields
Buchanan, C. M. 1C Leith
Cameron, Donald 2C Greenock
Crawford, Alex. 1C Leith
Dickson, Alex... 1C Greenock
Flight, Thos. .. 2C Leith
Gilchrist, Thos.. 2C ,,
Hepworth, John 2C Hull
Hill, George.... 1C N Shields
Howell, Morgan 1C Bristol
Kerr, James .... 1C Liverpool
Killey, E. W. .. 2C ,,
Macallan, Louis 2C ,,
McDonald, Jas.. 2C Leith
McDonald, John 2C Greenock
McFarlane, R. T. 1C ,,
McKay, Alex. .. 1C Leith
Morrison, Horace 1C Liverpool
Morrison, Wm.. 2C Leith
Pughe, Wm. W. 2C Liverpool
Ramsay, P. .... 1C Leith
Renton, James .. 2C N Shields
Wilson, James C. 2C Liverpool

September 12th, 1885.

Adam, Matthew 1C Glasgow
Allan, Peter .... 2C ,,
Annan, Jonathan 2C ,,
Appleby, Thomas 1C N Shields
Bioletti, Harry F. 1C London
Boase, Wm. M.. 1C N Shields
Bolam, F. W. .. 1C ,,
Dick, George .. 1C London
Drummond, T.R. 2C N Shields
Fox, Thomas J.. 1C Glasgow
Haddy, Stephen.. 1C London
Hall, John...... 1C N Shields
Harvie, John .. 1C Glasgow
Hayes, Harold J. 1C Liverpool
Irwin, T. E. .... 2C N Shields
Lazenby, H...... 2C Hull
Mason, Alex. .. 1C Glasgow
Malone, Matthew 1C ,,
McMillan, Geo... 2C ,,
McTaminey, L.. 2C ,,
Mundy, J....... 2C Hull
Neale, J. ...... 1C N Shields
Parker, Alex.... 2C Glasgow
Patterson, John 2C ,,
Risk, Allan G.. 1C London
Robertson, J. B. 2C N Shields
Sadler, Thomas.. 2C ,,
Sharp, Thomas.. 1C Glasgow
Sharp, Thos. H. 1C W Hartpl
Somerville, Alex. 2C Glasgow
Steel, M. ...... 1C N Shields
Stephens, Wm... 2C Plymouth
Stewart, Alex. .. 1C Glasgow
Still, John...... 1C N Shields
Thomas, Evan .. 2C Glasgow
Thomson, John.. 1C ,,
Waters, James.. 2C N Shields
Watt, John .... 1C Glasgow
Weir, Robert G. 2C N Shields
Winchester, A.. 2C Glasgow

The Old Eddystone Lighthouse, completed by John Smeaton in the autumn of 1879, has now been re-erected on Plymouth Hoe. A point of interest in the lantern is a handsome bust of Smeaton, rather more than two feet high, which has been placed under a plate-glass case to protect it from dust and other possible harm. A tablet in golden letters within the case itself informs us that it was presented by the Council of the Institution of Civil Engineers. It is a copy in plaster of a marble bust in the possession of the Institution.

The Marine Engineer.

LONDON, NOVEMBER 1, 1885.

EDITORIAL NOTES.

IT is much to be feared that the constant improvements and additions of mechanical devices, as applied to war vessels, may end in their becoming such intricate and delicate machines as to be easily put *hors de combat* in the rough and tumble struggle of a naval engagement. In some respects one of the latest of our additions to the navy, namely, the *Impérieuse*, is an illustration of this, inasmuch as in addition to two sets of main engines, there are no fewer than thirty-six auxiliary engines on board. As the whole of these are placed below the water-line, the engine spaces below are so cramped as to seriously handicap the contractors, and further, the other decks are much incommoded by top hamper for want of room to stow it below. On the other hand, the *Imperieuse* somewhat represents a simplification in mechanism used for laying and training the guns. The platforms are revolved and the guns trained and rotated by manual appliances. A worm and winch suffices to turn the turn-table, and it was found that three men could operate this winch with ease. The shot and charge are elevated to the breech by an ordinary block and tackle, so that there is no delicate mechanism here likely to be damaged in warfare. Modern improvements in construction seem to point out that the calibre of the guns may be much increased beyond what has hitherto been the case, as in the *Imperieuse* the original 18-ton guns proposed have now become 24-ton guns. The test gun has been mounted upon the Vavasseur system, and is one of the heaviest that has yet been mounted on this system. The guns are to be placed in barbettes, of which there are four,—one forward, one aft, and two built in the sides amidships, each barbette containing a single gun. The guns, being thus separated from one another, are not likely to be damaged simultaneously, as might possibly be the case where two are mounted in the same barbette. Twenty-four rounds were fired from the first gun in the forward barbette at the same time that the engines were going through their preliminary trials. The trial seems to have been exceptionably satisfactory, though the concussion of the heavy gun blew away the temporary hatches over the anchors, and broke a great deal of glass. With this exception no other damage was caused by the concussion of the discharges. Owing to the simplicity of the loading and training gear, the guns were handled by comparatively untrained men, and with very satisfactory results as to time.

THE Americans have effected at last an enormous improvement in the channel known as Hellgate, between Long Island and Ward's Island, which has hitherto been a great obstruction to ships passing to or from East River to the Sound. A rocky island, called the Flood Rock, in the channel narrowed it from 1,200 ft. to 600 ft., and so affected the tides that serious inconvenience was caused to the channel navigation; and as this was the most direct road between New York and Europe the American engineers have applied all their energy and ingenuity to the removal of the obstruction. As our American cousins are fond of gigantic enterprise. othing less would suffice to satisfy their ideas than the entire removal of the Flood Rock, which formed an island 9 acres in extent, and the removal was to be effected to a depth of 26 ft. at low tides. The operations were commenced as far back as nine to ten years ago, and the result has only just been achieved, with every success, according to the reports of the engineers. The whole of the island was undermined by tunnels, which were driven in every direction from two shafts. Their total length amounted to 21,670 ft., at a depth of 50 ft. below the low water level. The tunnels were at an average 10 ft. from floor to ceiling, and 6 or 8 ft. wide. The engineers encountered considerable difficulty from fissures admitting water, but they were successfully blocked with wood. Through the tops of the supporting pillars in the roof were drilled holes in every direction, averaging 9 ft. in depth, and from 4 to 5 ft. apart. These blast holes were loaded with cartridges of dynamite and rackarock, the holes being filled up to within a foot of the top with rackarock cartridges, and on the top of the rackarock was put in the holes a 15-in. dynamite cartridge. Altogether 14,000 cartridges were used, which were connected by electric wires with a suitable battery. When the day for the explosion arrived the electric circuit was closed by the little daughter of General Newton, the chief engineer, a child of eleven years old, who closed the electric circuit by pressing a button, and instantly caused the explosion. Ths appearance of the explosion is said to have been the uprising of a body of water, in shape resembling an iceberg, to a height of 200 ft., which was accompanied by a dull muffled roar like distant thunder. The effect of the explosion has been to shatter the entire mass of the rock, which now lies about in confusion on its former

resting place. It will probably take at least a couple of years more to move the *débris*, when a splendid channel will be conferred upon the European steam ship traffic to New York. This operation has certainly been a great triumph for American engineering skill.

A GREAT deal of interest is being excited by the trials which have lately taken place off the coast of Sweden, with the Nordenfelt submarine torpedo boat. This is not the first time that practicable suggestions for a submarine torpedo boat have been made. In fact, in a former issue, some time back, we noticed some successful experiments made with such a boat in the docks at Birkenhead, the boat being afterwards wrecked on the coast of Wales. But the trial of the Nordenfelt boat, above referred to, places the matter now quite within the range of "practical politics." The well-known and ingenious writer, Jules Verne, has already foreshadowed and given great reality to the idea of a practical submarine vessel, but it is a very different thing to write as a matter of fiction on such subjects on the one hand, and to see the apparatus in practical operation under one's own eyes on the other hand. The novelty of the exhibition naturally attracted a very large and representative number of visitors from every European Power, including Brazil and Japan, as it was thought that the practicability of the construction of such a boat would exercise an enormous and almost inestimable effect upon naval warfare in the future. There is already a very strong conviction in the minds of many eminent naval officers that torpedoes, operated even from torpedo craft of the present well-known construction, may prove the most powerful factors in naval engagements of the future, as one such vessel would, if successful in its attack, be capable of destroying the strongest ironclad afloat. Should, however, such torpedo boats be capable of sinking at will below the surface of the water and of proceeding on their murderous errand hidden from the observation of the enemy whom they are about to attack, the value of ironclads as a means of offence or defence would become enormously reduced. One of the eye-witnesses of the trial of the Nordenfelt boat very truly says, that it was not until those on board the gunboat, who were watching the experiment, saw the torpedo boat sink beneath the waves under their eyes, leaving no trace or indication of its presence, that they thoroughly realised the nervousness and demoralisation that would seize those upon an ironclad menaced by such an unseen and insidious attack. We describe elsewhere the details of the trial and of the construction of this boat. It was built at Stockholm about two years ago, and is cigar-shaped, with a projection on the top amidships, supporting a glass dome or conning tower, which enables the commander to see his way. It is through this aperture, when the dome is removed, that the crew obtain access into, and leave the vessel. The length of the whole is 64 ft., with a central diameter of 9 ft., built of Swedish mild steel, with plates ⅝ in. in thickness. The chief difficulties with which the inventor has had to deal has been the control of the movements of the boat, either to effect sinking or rising or to direct its movements when under the water. There are several alternatives by which such a boat can be sunk. It may be forced down by power applied from within, or weighted down by taking in sufficient sea water to destroy the buoyancy, or it may be steered down by the application of its ordinary motive power modified by a horizontal rudder. Mr. Nordenfelt has finally adopted the former of these alternatives, placing sponsons containing wells and vertical propellers on either side of the boat amidships. In order, then, to prepare for action, sufficient water is taken in to reduce the buoyancy until only the conning tower is above the surface, and to further sink the boat the vertical propellers are set in motion, the boat being held at the required depth by their action. The value of this arrangement is that any breakdown in the engines enables the natural reserve of buoyancy to once more assert itself and bring the vessel to the surface. The danger of the second alternative is that were the buoyancy destroyed by taking in a heavy charge of water any breakdown of the engines would prevent the vessel from coming to the surface again. The engines are driven by steam, and, consequently, when submerged the ash-pit is sealed and the vessel can depend only for its motive power upon the reserve of force carried down with her in her boilers. No special compressed air for the use of the crew, nor any chemical appliances for the renewal of the atmosphere, are provided; the crew depend, therefore, for existence, on the normal amount of air sealed up in the hold. As four men have found this supply of air sufficient for a period of six hours under water, it would seem to amply suffice for all requirements without the addition of further complications. Startling as a novelty as is the present boat, it is, admittedly, yet very imperfect, but so much has been done that it is obviously only a question of time and brains to perfect this appliance into the most dangerous weapon of the day. At present the speed of the vessel is very poor, not exceeding, probably, five knots an hour on the surface and not more than three knots an hour below the surface, nor was it submerged to any very great depth

or for any very considerable time at the trials, so that, although the boat as at present constructed may not be capable of effecting any serious revolution in marine warfare, it at the same time opens out possibilities which we have hitherto been able to neglect.

We notice that latterly the collapse of flues in marine boilers vies in frequency with the breakdown of propeller shafts, and may be characterised as a dangerous nuisance. We should be glad to hear from any of our readers under whose notice such accidents occur, as to whether they may be caused by ordinary weakness of the material of the flue under the higher pressures of steam now carried in marine boilers, or whether the flues are subjected to special deterioration and consequent weakness by an accumulation on the heated surface of incrustation. In view of the importance of the object we cannot do better than point out to our readers the respective causes of danger under those two heads. First, then, with regard simply to the danger of collapse in a flue of large diameter: it is well known to engineers that the resistance of wrought iron to the compressive strain to which a flue is subjected is much less than its power of resistance to the tensional strain to which the shell is subjected. Here, then, is the first inherent weakness in flues with material of the same thickness as in the shells. Diameter is a great factor in either weakness or strength; that is to say, the larger the flue the greater is its tendency to collapse, and on the average we should consider that the diameter of flues in marine boilers are on the increase. Similarly, the greater the length of flue unsupported, the greater its liability to collapse, and this can be only avoided by the introduction of flanges or supporting rings at different points in the length of the flue. The now well-known corrugated flues produced by the Leeds Forge Co., under Mr. Sampson Fox's patent, are specially designed by their corrugations to afford great strength against a crushing or collapsing strain. Theoretically, a flue is, when perfectly cylindrical, in its best form to resist collapsing pressure, as the pressure is all then resolved as compression upon the material. Should, however, any deformation in the shape of the flue occur from the perfect cylinder, the tendency to collapse is very much increased in the direction of the flattened sides. Now, in all cases where flues do eventually collapse, it is probable that they show a previous deformation in the direction in which they are about to collapse, and the proper notice of this change of form would frequently suffice to warn the engineer in charge, who might by staying, prevent the ultimate collapse; or, at any rate, reduce the working pressure until the danger was removed. The examination of flues as to their maintenance of form should be regularly conducted from time to time by means of a suitable gauge-bar, which could be easily inserted at the end of a rod and tried in different directions to ascertain whether any deformation was setting in. This, however, in practice is seldom done, as engineers in charge of boilers are apt to overlook the immense increase of danger of collapse after a very slight deformation has commenced. In raising the question for our readers' attention, as to whether collapse may not be due, in the first place, to heavy incrustation on the heated surface, we would impress upon their attention that such incrustation tending to allow the temperature of the plates to be raised, very materially reduces their strength, and thus hastens change of form and ultimate collapse. It is quite possible that an engineer in his anxiety to avoid corrosion, knowingly permits incrustation to a certain amount to accumulate upon the inside faces of his boiler plates, and there is no doubt that a thin layer of such incrustation is a great protection against corrosion, but it is easy to overdo this with lamentable consequences to the strength of the flue plates. We shall be glad to have any practical data on these points that our readers can afford us.

LAUNCH OF HER MAJESTY'S SHIP SEVERN.

On September 29th a large gathering of spectators assembled in the dockyard at Chatham to witness the launch of Her Majesty's ship *Severn*. This vessel, when completed, will be one of the most important additions which have been made to the Royal Navy. The *Severn* is an unarmoured fast steel cruiser, belonging to the class of the twin screw protected corvette, which includes the *Thames* and the *Mersey*. She is a more powerful vessel than the cruisers of the *Leander* type and possesses greater steam power. The principle followed in her construction has been that of the water-tight hull, and the main object which the designers have had in view is to guard as much as possible the boilers, engines, and magazines from danger. The *Severn* has been about two years in the course of construction, and is estimated to cost about £160,000. If the anticipations of her designers are realised, it is believed she will turn out to be one of the fastest cruisers in the service. Her principal dimensions are as follows:—Length between the perpendiculars, 300 ft.; extreme breadth, 46 ft.; mean draught of water, 17 ft. 9 in.; load displacement, 3,600 tons. Her armament will consist of two 8-inch breechloading guns, ten 6-inch breechloading guns, one 9-pounder boat and field gun, one 7-pounder boat and field gun, six 1-inch Nordenfelt guns, and two 45-inch Gardner guns. She will carry Whitehead torpedoes, and discharge them above and below water on each broadside. Although the hull is unarmoured, the vessel is provided with a 9-in. thick armour steel-faced conning-tower, steel protective horizontal deck-plating 2 in. thick, and 3 in. of the same on slopes. She will be fitted with horizontal compound engines of 6,000 I.H.P., made by Messrs. Humphry, Tennant & Co., of Deptford. There are two propellers, and the vessel is estimated to attain a speed of 17½ knots per hour. The authorized complement of her coal bunkers is 500 tons, and accommodation is provided for 300 officers and men.

In view of the ceremony of yesterday, preparations had been going on for weeks past, and the day when the huge vessel was

to be released from her fixings on the stocks found everyone and everything in the dockyard in a thorough state of preparedness. Nothing was lacking to constitute the proceedings a thorough and almost brilliant success. The weather unfortunately was somewhat ungenial. Rain had fallen in the earlier portion of the day, and although it cleared off before the time fixed for the ceremony, the sky presented a lowering appearance all the afternoon. From this cause the number of spectators was probably not so large as it otherwise would have been, but as it was the attendance was an enormous one. For several hours before the proceedings were timed to begin a steady stream of sightseers filtered through the dockyard gates. All the available standing room surrounding the vessel was speedily filled up, many hundreds of spectators betaking themselves to the deck of the unfinished cruiser as a vantage ground from which to witness the launching ceremonial.

Three o'clock was the hour fixed for the proceedings to begin. As the hour approached a large staff of workmen under the superintendence of Mr. Warren, the chief constructor, and other members of the constructive staff, made all preparations for the christening ceremony, which was performed by Miss Daisy Watson, daughter of Admiral Watson, C.B., Admiral Superintendent of the Dockyard. Among those who appeared on the raised platform to take part in the proceedings were Admiral Watson, Vice-Admiral Brandreth, Captain Lord Walter and Lady Kerr, General the Hon. R. Monk, Captain Buller, C.B., Chatham Naval Reserve, and Mr. Warren, chief constructor. Prayers having been read by the Rev. Mr. Dearden, a signal was given by the chief constructor, in response to which Miss Watson moved the lever holding the ropes. As the last support was knocked away a pause of a minute or two occurred, during which the vessel remained fast on the stocks. There was a momentary bustle and a flicker of excitement; but presently the vessel, obeying the slight pressure which had been applied to it, began to move from the fastenings which had retained it so long, and amid a storm of enthusiastic cheers slid swiftly into the Medway. As the *Severn* got fairly out of the slip the cheers were again renewed; the Royal standard, the Union Jack, and the Admiralty flag were hoisted on board the cruiser, and the band of the Royal Marines brought the proceedings to a close by playing "Rule, Britannia." It is expected that the *Severn* will be ready for her first commission in a few months.

PATENT HOPPER DREDGER FOR BELFAST.

On October 8th the first of the twin-screw patent hopper dredgers, constructed by Messrs. Wm. Simons & Co., Renfrew, to the order of the Belfast Harbour Commissioners, was successfully tried on the Clyde, at Port Glasgow. The moorings being got out and the ladder lowered, the dredging machinery was set in motion, and the ponderous buckets discharged their contents into the vessel's own hopper, the capacity of which is 800 tons. The dredger afterwards steamed down the Firth, where a trial of her speed took place, and, notwithstanding the unpropitious state of the weather, a mean speed of nine knots was attained, which was considered highly satisfactory. The following gentlemen were present:—Mr. Salmond, C.E., engineer to the Belfast Harbour Commissioners; Mr. Mollison and Mr. Edwards, representing Lloyds, under whose inspection the dredger was built; Mr. Brown, of Wm. Simons & Co.; Mr. Wiseman, inspector for the Commissioners; Mr. Anderson, of Singapore, &c. The following particulars of this vessel may be of interest: her dimensions are 185 ft. by 38½ ft. by 15 ft. 2 in. The bucket ladder dredges to a depth of 35 feet below the light water line. Steel has been used extensively in the construction of the buckets, tumblers, and wheel gearing, which will in a great degree minimise the wear and tear that necessarily takes place on these parts. She is fitted with two pairs of compound surface condensing engines of 800 I.H.P. and with all the most recent improvements, including Tangye's improved high-speed governors, steam starting gear, &c. The main boilers are of ample dimensions, and are constructed of steel, for a working pressure of 90 lbs. per square inch. An auxiliary boiler, also of steel, is fitted in stokehold, and will be used for circulating water in boiler or supplying steam to the winches. The vessel is steered by steam steering gear, supplied by Harrison, of Manchester. The buckets are driven at the rate of 20 per minute, and each has a capacity of 19 cubic feet (a cart load); which equals a quantity dredged and deposited of 1,100 tons per hour. This amount, of course, varies with the nature of the soil to be dredged. An independent engine is fitted up in the forward end of vessel for raising and lowering the bucket ladder. The bow and stern winches for manœuvring the vessel are of the most powerful description and of special design. They are triple geared, and have each three separate chain barrels; also warping ends are fitted for use at quay walls, &c. The officers' and crew's quarters are very commodious, and comfortably fitted up, and arranged separately on each side of the bucket well. Experience has proved that in providing themselves with these hopper dredgers the Harbour Commissioners of Belfast are adopting the most economical system of dredging, and it is intended that these vessels work night and day, and will be chiefly engaged in cutting a deep-sea channel of considerable length in the lough. This work will be greatly facilitated by means of the builders' patent traversing gear, which will enable the vessels to approach shoals, and cut banks in advance of them to a depth of thirty-five feet. Independent, however, of the part they will perform in the making of the channel, they will be found most suitable for harbour and dock work, as the traversing arrangements above alluded to will enable them to dredge into corners or alongside quay walls. Altogether these vessels present a very smart and substantial appearance, and seem well fitted for the work they are to undertake at Belfast. The Harbour Board and the chairman, Sir Edward James Harland, Bart., and Mr. T. R. Salmond, their engineer, under whose direction these vessels have been constructed, are to be congratulated on having such effective machinery for the purpose to which they will be put. This is the twenty-first hopper dredger constructed by Wm. Simons & Co., who are the inventors and originators of the system, and vessels constructed by this well-known firm for Newhaven (Sussex), Port Adelaide, and elsewhere have done their work at 50 per cent. less cost than by the old style of dredging.

A TEST FOR PURE MANILA ROPE.

It is repeating a truism to state that the safety of a ship and her crew frequently depends upon the trustworthiness of a single rope. Hence, in all contracts for ropes, whether for the Royal Navy or for the mercantile marine, the best pure Manila hemp fibre is always specified, or at any rate should be, this fibre being the finest and strongest of any. Manila rope, therefore, means the best that can be procured and the rope which is generally used, or rather which was generally used before an unrecognisable adulterant was discovered. Formerly there was no inferior fibre that could be introduced into a rope without its presence being readily detected. Some four or five years since, however, a new fibre known as Sisal hemp was introduced into the market, being so named from the place where it is produced, which is Sisal, Yukatan, in the Gulf of Mexico. This fibre has an excellent appearance closely resembling that of Manila hemp, but it possesses only half the strength and one third the durability of the latter. Hence it is unsuited for the manufacture of rope for shipping, or, in fact, for any purpose where a sound and reliable rope is required, especially where sudden and excessive strains have to be met. The price of Sisal hemp, moreover, is only about half that of Manila, and hence an inducement is offered to unprincipled rope manufacturers to mix the two kinds of fibre in rope and supply it as a pure Manila hemp rope. It is well known that advantage is but too frequently taken of this inducement, the manufacturer well knowing that there is little or no chance of the purchaser ever detecting the fraud. To do this he must either possess a testing machine or send samples of his ropes to be tested, which is a tedious and expensive matter. In the case of the Royal Navy it might be expected that the case would be different and that the Admiralty would have every coil of rope not made in the Government establishments tested for tensile strength as supplied. This, however, we are credibly informed is not done, and careful as the Admiralty is to test their chain cables, their hawsers and other hemp ropes are taken on the faith of the manufacturers. In view of the value and importance of a good rope, it is, therefore, to be deplored that hitherto there has been no simple and ready method of detecting the presence of an inferior fibre like Sisal in a rope presumably made of pure Manila hemp.

The difficulty of detection, however, now no longer exists, as we have just had demonstrated to us by Messrs. Frost Brothers, the old-established rope manufacturers, of Shadwell. The test is as simple and as easy of performance as can well be conceived, and we will describe it as we saw it carried out by Messrs. Frost, who are desirous that it should be as widely known as possible.

Messrs. Frost produced three pieces of 3-inch rope, one made from pure Manila hemp, one from pure Sisal, and one from an equal mixture of Manila and Sisal, the fibres having been carefully intermixed before the yarns were spun. Each of the ropes was untwisted, and from a strand of each was taken a piece of the yarn about six inches in length. Each piece of yarn was untwisted and separated into loose fibres, which were separately rolled between the palms of the hands, producing three balls of fibre each about the size of a large walnut. These three balls were then placed on an iron fire-shovel and each lighted and thoroughly burned out. There were then three piles of ashes of perfectly dissimilar appearance. The Manila hemp produced an ash having a dull grayish-black appearance; the Sisal hemp left an ash of a whitish-gray colour, while the combined Manila and Sisal fibre gave a grizzly white and black ash, reminding one of nothing so much as a man's beard when turning from black to gray. The presence of the two fibres was distinctly apparent by the different colours of the ashes. We thus have a very simple solution to a very important difficulty, and it is now open to any one, whether a merchant or the owner or commander of a vessel, to test the rope which may be supplied to him and to ascertain for himself whether or not pure Manila hemp alone has been used in its manufacture, always assuming of course that pure Manila rope was ordered by him. The application of this test must be the means of detecting fraud and may be the means of saving many valuable lives and much property, while the knowledge that a means of detection exists should act as a deterrent to those who have a greed of unholy gain.—*The Times*.

H.M.S. IMPÉRIEUSE.

THE FASTEST ARMOUR-CLAD AFLOAT.

A MOST satisfactory series of trials with the *Impérieuse* have taken place at Portsmouth during the past month, and they have proved a success throughout. It will be remembered that this vessel is a new barbette armour-clad of 7,450 tons displacement, and the first of a new class in which (to use the words of Mr. Trevelyan when describing the design to the House of Commons), it was intended "to combine the speed of the *Leander* class of cruiser, with guns of greater power than the *Thunderer* or the *Devastation* possessed." The keel was laid on the 10th of August, 1881, and the vessel was floated out of dock on the 18th of December, 1883*, the christening ceremony being performed by Princess Edward of Saxe-Weimar. The speed for which the ship was designed was sixteen knots per hour, but this was greatly exceeded on the trial, as will be seen below.

The engines and machinery of the *Impérieuse* have been manufactured and fitted on board by Messrs. Maudslay, Sons & Field, of London. They consist of two sets of three-cylinder compound inverted engines, in general design and arrangement very similar to those fitted on board the *Colossus* by the same makers, and which have given very satisfactory results. One great alteration has, however, been made in their construction, by substituting cast steel for cast iron in the main foundation and crank bearing frames, and also in the standards for supporting the cylinders, whereby a considerable saving in weight has been effected; and it is believed that these are the first engines of such large dimensions in which cast steel has been so extensively used. Each set of engines has one high-pressure cylinder, 55 in. in diameter, placed forward, and two low-pressure cylinders 77 in. in diameter, the stroke being 4 ft. The cylinder linings are of Whitworth's fluid compressed steel; the pistons are also of steel, of one thickness only, dished in form, and are secured to the piston rods by a flange with several bolts, a method which is found to give much greater security than the usual coned end and nut. The low pressure slide valves are of the common type, double-ported; but single-ported piston valves are fitted for admitting the steam to the high-pressure cylinders, the spring rings being of phosphor bronze, held out by spiral springs. The piston rods, slide rods, crossheads, connecting rods, and nearly all parts of the working gear are of steel. The crank shafts are made in three pieces, which are interchangeable, the cranks being placed at an angle of 120° with each other; they are hollow, and made of Whitworth's compressed steel. The propeller shafting is also hollow, and of the same material. The surface condensers together with the air pumps and hotwells are made of gun metal, and the condensers are constructed so as to be worked as common jet condensers if required. Each condenser contains 5,434 brass tubes ¾-in. exterior diameter, with a cooling surface of 8,000 square ft. The cold water is circulated through the condensers by centrifugal pumps, driven by independent vertical direct-acting engines, having a stroke of 15 in., the diameter of the cylinders being 16½ in., and the diameter of the fans 3 ft. 9 in. These pumps are also arranged for pumping water out of the ship in case of accident, and are capable of discharging overboard 1,400 tons of water per hour, provision being made for a direct suction of water from the bilge instead of its having to pass through the condensers. Each set of engines has two air pumps 30 in. in diameter, worked by wrought iron beams by means of links from the cylinder crossheads, and there are two feed and two bilge pumps also worked by these beams. The feed tanks are of wrought iron, well stayed, each having a capacity of 130 cubic ft. The screw propellers are of the latest improved type, 18 ft. in diameter, four-bladed, the blades being made separate and capable of adjustment from 20 ft. to 24 ft. pitch.

The boilers are twelve in number, and are placed in four different watertight compartments, two of the compartments being forward and two aft of the engine rooms. In each of the forward compartments there are two oval boilers with return tubes over the furnaces; while in each of the after compartments there are four cylindrical boilers with the tubes placed beyond the furnaces, these boilers being raised in the vessel so as to allow the screw alleys and the two lines of shafting to pass under them. The total firegrate surface in all the boilers is 676 square ft., and the total heating surface 22,800 square ft. The tube plates and combustion chambers are made of best Yorkshire iron, the shells are of Siemens-Martin steel, and the furnaces are corrugated by Fox's patent. The safety valves are of the latest approved type, with spiral springs of square steel, and loaded to 90 lbs. per square in. The stop valves are placed horizontally, and are self acting.

The whole of the stokeholds are arranged for working with forced draught when the engines are working up to their full power, all the openings into the boiler rooms being fitted with air-tight shutters; and the doorways are provided with airlocks of considerable size, so that two men can pass through at the same time. For the purpose of producing and maintaining the air pressure, there are eight fans driven by small horizontal engines, the four fans for the forward boilers being 4 ft. 6 in., and the four for the after boilers 5 ft. in diameter. The air for these fans is supplied through large cylindrical trunks, surmounted by cowls placed as high as possible, but means have been provided whereby the four forward fans can exhaust the hot air from the engine rooms when required and deliver it into the forward boiler rooms for supplying the furnaces. Escape ladders and doors have been fitted to the boiler rooms where possible, the doors flying open immediately they are released, so as to give those in the stokehold a chance to escape should any accident happen when the boiler room is closed up and under forced draught. There are two telescopic funnels, 70 ft. high from the ashpits, with armour bars fitted across at the level of the steel deck.

In addition to the auxiliary engines already mentioned there are four fan engines, with fans 4 ft. 6 in. in diameter, for ventilating the magazines and other parts of the ship below the steel deck, two powerful horizontal fire engines which can be worked coupled or separately, six double-cylinder feed engines of Admiralty pattern, two double-cylinder bilge engines, two turning engines, and six ash-hoisting engines, all made by Messrs. Maudslay; steering engine by Messrs. Forrester, of Liverpool; capstan engine by Messrs. Harfield; air-compressing engines by Messrs. Brotherhood, of London; two pumping engines for the Normandy condensers, and a two-cylinder engine for driving the machinery in the engineers' workshop, made at Portsmouth factory; and it is intended to fit three engines for working the Siemens dynamo machines for the electric light. The whole of these auxiliary engines exhaust their steam into a separate auxiliary condenser, placed in the port engine room, the water from the condensed steam being conveyed into large drain tanks placed under the forward boilers, whence it can be pumped into the feed tanks. There is a most elaborate series of drain pipes, the drains from all the steam and exhaust pipes, and from the whole of the auxiliary engines throughout the vessel, being taken into a main pipe connected with the drain tanks just mentioned. All the places in the main and auxiliary steam pipes, where it is possible for water to lodge or accumulate, have been provided with automatic steam traps, which have been found to act admirably and keep the pipes clear of water. Means have been provided for allowing the steam from the boilers to pass direct

*A full account of the floating out of dock, with details of the vessel, will be found in the *Marine Engineer*, vol. v., pp. 289, 290, and 311.

into the main surface condensers when the ship is suddenly stopped at sea, or when entering harbour at reduced speed, so as to prevent the rush and noise of steam passing through the waste steam pipes on deck. Four of Friedmann's patent ejectors are fitted for the purpose of clearing the bunkers of water in the event of their being flooded. On trial these were found capable of discharging over 1,000 tons of water per hour, but at the loss of a great quantity of steam. The main engines are fitted with Messrs. Durham & Churchill's patent velometers, to minimise the racing as much as possible. As the engine and boiler rooms are very much confined, great attention has been paid to the question of lagging, and all hot surfaces throughout the ship have been covered with silicate cotton and canvas, or felt and wood, with the result that the temperatures are kept very low. Any written description of the machinery and various arrangements is wholly inadequate to give a fair idea of their complexity, and it would seem as if the maximum of complication had been reached in this vessel.

Hitherto the contractors' trials have usually been made with the ship very light, with the result that a speed has been obtained that is rarely, if ever, attained again when the vessel has her guns and stores on board, and is really in seagoing trim; but it was determined to make a new departure on this occasion, and to have the trials with the ship at her normal load draught. With this object 700 tons of water were admitted into the double-bottom and forward compartment, bringing her down to the draught of 24 ft. 6 in. forward, and 25 ft. 6 in. aft. As it was considered best to have clean salt water in the boilers for the trials, the ship was towed out to Spithead on Oct. 13th, and the full power trial took place on the following day with a smooth sea and light wind. The vessel was in charge of Captain Tracey, of the Portsmouth Steam Reserve, the navigating duties being performed by Staff-Commander W. L. Dodds. Mr. F. C. Alton, Chief Inspector of Machinery, was present on behalf of the Steam Reserve; Mr. J. T. Corner attended from Portsmouth Dockyard; Mr. R. Sennett especially attended to direct the trials on behalf of the Admiralty; and Mr. Robert Barnaby, of the Royal Corps of Naval Constructors, under whose directions the building of the vessel has been carried out, was also present. The contractors' firm were represented by Mr. Walter Maudslay, Mr. C. Sells, the designer of the engines, and Mr. H. Warriner, the manager for Messrs. Maudslay, who had charge of the engines throughout the trials, assisted by Mr. C. de Grave-Sells, the assistant manager, and Mr. J. Vernon, foreman. There were also on board Mr. J. Jefferies, the chief engineer of the ship, and Mr. W. Main, who was in charge of the hull on behalf of the Constructors' department.

The vessel got under weigh at 8.30 a.m., and the stokeholds were closed up, the trial commencing soon after. The results of the first half-hour proved very satisfactory, the indicated horse-power being 10,529, with the steam still rising; but soon after the commencement of the second half-hour one of the fan engines in the port forward boiler room broke down, the air pressure in the stokehold being reduced from $1\frac{3}{10}$ in. of water to $\frac{1}{10}$th in., and the pressure of steam falling in proportion.

The broken part of the fan engine having been replaced, the fan was started again during the sixth half-hour, and the steam and power quickly rose, as will be seen from the detailed report below. In the other boiler rooms the air pressure was maintained throughout the trial at a pressure equal to that of $1\frac{1}{10}$ in. of water, the fan engines running about 500 revolutions per minute. The trial proceeded uninterruptedly from end to end, the result of the half-hourly observations being as follows:—

Half Hours.	Pres. of Steam.	Vacuum.		Revolutions.		I.H.P.
		Starbd	Port.	Starbd.	Port.	
	lbs.	ins.	ins.			
1	83¼	27	28	87·26	88·66	10,529·97
2	79½	27½	28	86·90	87·83	10,102·79
3	80½	27	28	85·76	86·96	9,944·69
4	81	27½	28	87·23	87·60	9,907·25
5	81	27¼	28	86·76	87·40	10,039·47
6	80	27½	28	86·00	86·50	10,086·54
7	81¾	27	28	87·23	88·00	10,500·13
8	81	27	28	87·70	88·46	10,363·55
Means.	81	27¼	28	86·85	87·66	10,184·29

The engines worked well and smoothly throughout, there being an utter absence of vibration. Satisfactory as the result was, there can be little doubt that it would have been still better had the full air pressure been maintained in all the stokeholds, and if the mean is taken of the results of the first and the two last half-hours when the fans were in perfect action, a more accurate idea may be formed of what the engines are capable at their full power. The result thus obtained is 10,464 I.H.P. During the earlier part of the trial four runs were made at the measured mile in Stokes Bay with the excellent result of a mean speed of 17·213 knots per hour, the maximum being 18·2 knots, the greatest speed yet attained by any armour-clad afloat. No appreciable vibration was experienced even in the after part of the ship, this being partly due to the propellers being so exactly suited to the vessel both in diameter and form, and partly to the steel hull being sheathed with wood, which tends to absorb any commotion produced by the propellers. Indicator diagrams were taken during the runs on the mile, the mean I.H.P. being 10,185, 27 per cent. over the contract power, which was 8,000. The consumption of coal was 2·3 lbs. per I.H.P. After the conclusion of this trial the usual stopping and starting tests of the main engines were made, and then half an hour's run with the jet injection. These proved satisfactory, and trial was made of the steering engine and gear, the half-circles to starboard and port being accomplished in 2 min. 14 secs., and the handiness of the ship giving great satisfaction. The vessel then proceeded to her anchorage at Spithead, where the anchor trials took place on the following day.

As the *Impérieuse* is the first ship of a new class, it was decided by the Admiralty to make an exhaustive trial at various speeds and to test the rate of consumption at these speeds. With this object the vessel was taken out again on October 16th, the same officials being present as before, with the exception of Mr. Alton, who was represented by Mr. W. P. Davis, chief engineer of the *Collingwood*. Two runs were first made at 8 knots, and two runs at 9 knots, the results being shown below. It was then decided to have a trial of four hours at the speed of 10 knots, and the ship made four runs on the measured mile for the purpose of determining the exact number of revolutions that the engines would require to make to obtain that speed. This having been ascertained, the four hours' trial commenced, half-hourly observations being taken as on the full-power trial, and the quantity of coal used being carefully measured. The mean results were as follows:—

Speed.	Pressure of Steam.	Vacuum.		Revolutions.	I.H.P.
		Starbd.	Port.		
	lbs.	ins.	ins.		
8 knots.	60	29·0	29·0	35	825
9 ,,	62	29·0	29·2	43	1,344
10 ,,	61·3	29·0	29.5	48	1,582

The consumption of coal at the 10 knots' speed was only 1·92 lb. per H.P. per hour, so that at this rate of speed the vessel could steam continuously for 37 days, without having to call at a coaling station, and covering in that time 8,950 miles. This completed the trials, which, throughout, proved very satisfactory, and one of the most noticeable features of which had been, that there was not the slightest forcing of the engines or boilers; and there is no doubt that the vessel will be able to maintain her power and speed through a long commission, and until it becomes necessary to reduce the working pressure of the boilers in accordance with the Admiralty rules. The *Impérieuse* was taken into harbour on the following day, and is being completed and made ready for commission with all speed.

INTERNATIONAL ANTI-FOULING COMPOSITION VERSUS COPPER SHEATHING.—Messrs. Holzapfel & Co., of Newcastle-upon-Tyne, have heard from their agent in Sydney, New South Wales, of a singular test which he made with their composition on two harbour steamers. The *Zevirette* and *Britannia*, two steamers belonging to the Sydney Harbour Trust, are covered with copper sheathing, and part of the two boats were painted with the International Anti-fouling Composition. After six months the boats were redocked, and on examination it was found that the copper sheathing was covered with fouling matter, while the composition was still perfectly clean and in good condition. As the copper sheathing is more than ten times more expensive than composition, and has so far been considered the best anti-fouling medium, this speaks well for the quality of Messrs. Holzapfel and Co.'s composition.

THE HISTORY OF PADDLE-WHEEL STEAM NAVIGATION.*

(*Continued from page* 178.)

By Mr. HENRY SANDHAM, of London.

STERN-WHEEL STEAMERS.—These seem never to have taken firm root in England. A few are working on our canals as tow-boats only. In 1878 Messrs. Yarrow & Co., Poplar, turned their attention to this class of steamer for the navigation of the shallow rivers of South America. The *Inez Clarke*, 130 ft. by 28 ft., with a draught of only 15 in. and a speed of 15 miles per hour, is an example of modern stern-wheel propulsion. The stern-wheel is driven by high pressure compound horizontal engines, having cylinders about 15 in. and 27 in. diameter, with 4½ ft. stroke. The boiler is of locomotive type, and supplies steam at 120 lbs. per square inch. The engines are placed right aft, whilst the boiler is right forward, to secure balance and even keel to the vessel in working. Mr. Morey, U.S.A., is said to have experimented in America, with oars and wheels, particularly with stern wheels, 1790 to 1797.

Another paddle-wheel steamship to be referred to on this occasion is the *Great Eastern*, iron built in 1857 on the Thames by the late John Scott Russell from designs by Brunel. The ship was propelled by both paddle-wheels and a screw-propeller. The paddle engines designed by Mr. Scott Russell in 1853 had four oscillating cylinders working diagonally (two and two) on the main-shaft cranks. They were 1,000 N.H.P. The cylinders were each 74 in. diameter with 14 ft. stroke, making 14 revolutions per minute. They formed two distinct engines, and had each their own air-pumps, condensers, and other needful accessories. Each cylinder, cast in one piece, weighed 28 tons. The condenser weighed 36 tons. The upper frames of the engines, cast in four pieces, weighed 13 tons. The intermediate crank-shaft was 26 in. diameter and 22 ft. long, with main cranks 7 ft. long between centres; it weighed 30 tons, and was made by Messrs. Fulton & Neilson, Lancefield Forge, Glasgow. The total weight of the paddle-shaft was 80 tons. The diameter of the paddle-wheel was 58 ft., equalling an advance of 60 yards in one revolution. They could be disconnected from or coupled to the engines at will. Though remarkable as being the largest iron built vessel ever constructed, it is understood that the ship is now practically laid aside; consequently she may become entirely forgotten.

HYDRAULIC OR WATER-POWER PROPULSION.—Water forced out by pumps and a steam-engine, along sides or at stern of a boat. Ramsay or Rumsey, U.S.A., proposed this method of propulsion, carrying out a series of experiments in America from 1784 to 1793, and afterwards in London in 1805 with James Watt. Messrs. Ruthven, of Edinburgh, took up the same idea again in 1843. In 1866 a small boat called the *Nautilus* was fitted out for testing Mr. D. Ruthven's improved arrangements and proposals of 1849. She proved herself worthy of further trial and development; which at length culminated in the application by the Admiralty of the hydraulic or water-power system in 1866 to H.M. armour-plated ship *Waterwitch*, of 778 tons burden, built by the Thames Ironworks Company, Millwall, with engines of 160 N.H.P. by Messrs. J. & W. Dudgeon, of Blackwall, driving a centrifugal pump. The pump had a horizontal fan or turbine wheel 14½ ft. diameter, by which the water fed to it through perforations in the vessel's bottom was forced out with great velocity through pipes laid fore and aft along the ship's side, on the line of her flotation. The direction given to the water jet from the pump, by means of regulating or controlling valves, caused the ship to go ahead or astern without any alteration in the motion of the engines.

John Allen, M.D.—author of "Specimina Iconographica," London, 1730—had proposed the water jet mode of propulsion in 1730. A pump or other means was to be employed for projecting a driving stream of water from the vessel.

There have been seen working on the Thames from time to time some curious schemes for driving small steamers. Particulars about these would be very interesting and instructive.

The *Locomotive*, about 1840, a paddle-steamer working up the river to Richmond and Hampton Court. She was iron built, by Ditchburn, and fitted by Braithwaite & Milner entirely on the plan of the locomotive high-pressure boiler and engine. The exhaust was carried direct into the boiler funnel, causing the locomotive beats; hence the boat's name. She was followed by the *Cardinal Wolsey*, fitted with a single direct-acting engine by the same makers, and for the same service.

The *Propeller*, about 1845, an iron vessel driven by two huge dash-boards in lieu of paddle-wheels. These dash-boards were driven with the walking action of a "daddy long legs" or spider, by means of levers connected with the engines, which also drove the boards reversely as required so as to obtain "ahead" or "astern" motion of the vessel. The *Propeller* ran between Greenwich and Blackwall, but did not enjoy a long or successful career.

A small boat driven by a huge dash-board at the stern, which was thrust into the water by a pair of engines through rocking levers, was persevered with for a long time, but it seems never to have attained practical value.

It appears that from 1783 to 1791 Mr. Fitch, an American inventor, had experimented with his proposals to propel a vessel by means of shovels driven or worked by a steam-engine. In 1791 he tried to introduce his plans into France.

AMERICAN BEAM-ENGINES.—The American plan of driving paddle-wheel steamers by a single powerful beam-engine has never met with favour in Britain. The steamers *North America* and *New World* are types of these American vessels. The *New World* was built in 1849 and engined in 1850 by T. F. Secor, of New York. She was 376 ft. long, 36 ft. beam, 10½ ft. depth of hold. She had a single engine, with the frame of wood, and a cast-iron skeleton beam trussed with wrought iron, 26 ft. long by 26 in. deep at main centre. The connecting-rod to the crank was also of iron and trussed. The cylinder was 76 in. in diameter, with a stroke of 15 ft., and made 18 strokes per minute. The paddle-wheels were 45½ ft. in diameter, the floats 11¾ ft. long by 3 ft. deep. The steam pressure in the boilers 30 to 35 lbs. per square inch; 6,000 lbs. of anthracite coal was burnt per hour. The speed of the *New World* was as much as 20 miles per hour. The steamers on the river Hudson are usually fitted with condensing engines, whilst those on the Mississippi have chiefly non-condensing engines. Messrs. A. & J. Inglis, of Pointhouse, Glasgow, have recently furnished a fleet of iron steamers for service in China, mostly engined with a single-beam engine. The *Hankow*, built 1873, the *Ho-Nam* and the *Kiang-Yu*, built in 1882, are three of their vessels. The *Hankow* is 308 ft. by 42 ft. by 15½ ft., gross tonnage 3,073. The engine cylinder is 72 in. in diameter, stroke 14 ft. The wheels are 38 ft. in diameter. The vessel's speed is 13 knots per hour. The *Ho-Nam* was fitted with a beam engine on the compound system, having two cylinders at one end of the beam. The *Kiang-Yu*, with others, was fitted with compound diagonal engines. In 1884 two sister vessels, the *Saturno* and *Olympo*, were completed by Messrs. Inglis for service on the river Plate, South America. Each was 286 ft. by 34 ft. by 12 ft., and was fitted with a compound beam-engine having two cylinders at one end of the beam; the speed on trial averaged 15½ knots per hour.

TUGS.—Paddle-wheel steamers for towing purposes still continue to be built for sea and river service all round our coasts. The following paddle tugs are mentioned in illustration, and as representing this class of paddle-steamer.

The *Paul*, built by Messrs. Laird Brothers at Birkenhead in 1880-81, 130 ft. by 25¾ ft. by 15½ ft., was fitted with two sets of independent engines, which could be connected or disconnected and worked separately at will. They were on the compound system with inclined oscillating cylinders, each set of engines having two cylinders of 28½ in. and 48 in. diameter and 5 ft. stroke; collective power 941 I.H.P.; working steam pressure 60 lbs. per square inch. Speed 10·9 knots per hour.

The *Albatross*, built at South Shields by Messrs. Hepple & Co.; 140 ft. by 19 ft. by 8½ ft. Lever engines of 53 N.H.P. Speed 13 knots per hour.

The *Mount Etna*, built in 1880 by R. Chambers, Dumbarton; 145 ft. by 21½ ft. by 13½ ft. Engines by Rankin & Blackmore, of Greenock, with compound inclined cylinders of 25 in. and 48 in. diameter and 5 ft. stroke; working steam pressure 70 lbs. per square inch.

The largest paddle-wheel tug recently completed is perhaps one built in 1884, from designs by Mr. McGregor, by Messrs. Alley & MacLellan, of Glasgow, 240 ft. by 35 ft. by 8 ft., with engines of 1,000 I.H.P.

At Belfast there was completed in 1882, by Messrs. MacIlwaine and Lewis, the paddle steamer *Monkstown*, 140 ft. by 16 ft. by 8 ft. She was fitted with oscillating engines; and, with her sister, the *Albert*, is employed for service at Cork.

STEAM FERRIES.—The well known ferry steamers plying across the river Mersey to and from Liverpool may be recorded as a special type of paddle-wheel steamer. They are iron built,

Read at a Meeting of the Institution of Mechanical Engineers, March 20.

having both ends alike, and run at equal speed either end first. The *Cheshire*, one of the earliest, 150 ft. by 30 ft. by 12 ft. in hull, 48 ft. extreme width, 130 N.H.P., was built in 1863 at Liverpool by Hill, Lawrence & Co., from designs by the late Mr. C. Harrison, and has been followed by several similar steamers. On the Thames a scheme was started in 1876 for a service of steam ferry-boats across the river below London Bridge. Two paddle-steamers were put on duty, the *Jessie May* and the *Pearl*, about 85 ft. by 42 ft. by 9 ft., 30 N.H.P., working with steam at 35 lbs. per square inch. They ran either end first, and were designed to carry simultaneously horsed vehicles and cattle, as well as passengers. Owing to many difficulties this ferry was ultimately given up.

STEAM TRAWLERS.—Another useful application of paddle-wheel steamers is as steam-trawlers in the North Sea fishery. The *Flying Dutchman*, built in 1880, the *Flying Fish*, built for Mr. J. Siddell, at Sunderland, in 1882, of 90 N.H.P., and the *Constance*, built at South Shields, in 1882, by Eltringham, with engines of 40 N.H.P., represent a recent and special class of modern steam fishing craft.

In conclusion, it may perhaps be safely predicted that there still remains for the paddle-wheel a prolonged career of useful service.

PATENTS FOR PADDLE-WHEELS.

Thomas Savery - - -	1697-8.
Jonathan Hulls - - -	1736.
Patrick Miller - - -	1787.
John Morgan - - - -	1812.—Feathering wheels.
Charles Baird - - -	1815.—Feathering wheels.
John Oldham - - -	1820.—Feathering wheels.
James Seaward - - -	1825 to 1841.—Feathering wheels.
E. Galloway - - - -	1829.—Feathering wheels.
J. Spurgin - - - - -	1837.—Chain wheels.
Joshua Field - - - -	1838.—Cycloidal wheels.
G. Rennie - - - - -	1839.—Float-boards and paddle-wheels.
D. Napier - - - - -	1841.—Feathering wheels.
J. J. Brunet - - - -	1843.—Reefing wheels.
H. Maudslay - - - -	1843 to 1846.—Feathering wheels.
W. C. Golling - - -	1865.—Feathering wheels.
J. J. Aston - - - -	1875.—Disc wheels.
McLellan and Owen -	1882.—Canal-boat wheels.
	And many others.

THE MANCHESTER SHIP CANAL.

IN the concluding remarks of our article upon the Manchester Ship Canal, in the September number of this journal, we stated that the intended waterway is reasonably calculated to become one of the leading works for the investment of capital. Recent speeches and events have confirmed this opinion very strongly, and particularly the statements of Mr. Daniel Adamson and Mr. Pember, Q.C., at a crowded meeting held at the Manchester Free Trade Hall, on the 5th ultimo, in support of the scheme, and the announcement of the Liverpool correspondent of the *Times*, on the 17th, that the Messrs. Rothschild have agreed to finance the canal.

Its enterprising chairman stated at such meeting that this waterway could not, in a year after it was completed, pay less than 6 per cent. to its shareholders, "and after the second year it could not pay less than 8 per cent., and there was a prospect that before eight or ten years had elapsed that the dividend would have reached 16 or 20 per cent. It would be impossible to prevent it. He had had some experience of estimates in his own business, and he must say that he had never seen an estimate drawn up in which he had more confidence than he had in those connected with the Manchester Ship Canal. It was true that the canal had opponents amongst railway men, amongst sluggish and indifferent men, and amongst ignorant and stupid people who would not take the trouble to look into the matter; but whoever investigated it in a reasonable manner would observe that the canal would be a paying concern, and that there was as little risk in making the canal as anything of a speculative kind that could be put forward by a human being. He gave his word of honour that he was not saying more than the truth that investors would be well recompensed for their expenditure. For himself he was willing to risk all that he had got, because he knew that before the end came he would be well recompensed for his courage, and that there was no risk of disaster." In the speech of Mr. Pember, Q.C., which followed, he fully and satisfactorily described the very profitable commercial results which the canal would produce.

From the prospectus of the Manchester Ship Canal Company some very interesting particulars are given respecting the capital outlay, estimated expenses of working and maintenance, and estimated trade and revenue, which we think it important to notify. The Bridgwater undertakings will cost £1,710,000. These belong to the Bridgwater Navigation Company, and consist of the canals known as the Bridgwater Canals and the Runcorn and Weston Canal, in addition to large warehouses and wharf accommodation in Manchester, docks and warehouses at Runcorn, and the Duke's dock and large warehouses at Liverpool. The Ship Canal and the incidental works will probably cost £5,328,848, and the outlay for the Mersey and Irwell undertaking will be £460,000. This includes the Mersey and Irwell navigation of the Runcorn and Latchford Canal, large warehouses at Manchester and Warrington, and the old Quay docks at Runcorn. It is stated that "the Mersey and Irwell navigation will be absorbed in the construction of the Ship Canal, but the Bridgwater Canals form a separate undertaking and will continue to be a barge navigation between Manchester and Liverpool, *viâ* Runcorn, and will constitute a most valuable feeder and distributer of traffic to and from the Ship Canal, by connecting it with the pottery and iron districts of Staffordshire, *via* the Trent and Mersey Canal, the Wigan district and the South Lancashire coal fields, and with nearly all the towns engaged in the cotton trade, and with Yorkshire and Derbyshire, *via* the Rochdale and other canals." The before-mentioned cost of these undertakings "will make the purchase a good investment, whether looked at separately or as part of the general undertaking of the company. The average net income of the Bridgwater undertakings during the last five years has been upwards of £60,000 per annum. It has been derived from the Bridgwater canals and those other portions of the Bridgwater undertakings which will continue in full operation notwithstanding the construction of the Ship Canal. he Bridgwater Canal undertaking is in good working order. For several years a large sum has been annually spent out of income upon permanent improvements which are now nearly completed. The directors are satisfied that the traffic of the Bridgwater Canals will, under the management of the Ship Canal Company, be capable of considerable development, by the removal of the Bar tolls which obstruct through traffic and by the opening of the canal to general carriers. The purchase of the Bridgwater undertakings will be completed as soon as the necessary capital has been subscribed, and the immediate receipt for the payment of dividend will be thereby secured." The cost of the railway deviations is estimated to be £440,892; the docks at Manchester, Salford, and Warrington, including a branch railway at Warrington, £1,403,232, while the parliamentary expenses will amount to £150,000. The total cost of and incident to the Manchester Ship Canal is thus £9,032,972. These estimates are based upon parliamentary investigations, and include a sum of £573,528 for contingencies. If under the borrowing powers of the company £1,800,000 out of the total of £9,032,972 is obtained, then £7,232,972 would be the amount to be raised in share capital, and therefore leaving unexhausted capital powers of £967,028. It is stated that the works may be completed within four years.

With regard to the expenses of working and maintenance no account is given of those of the Bridgwater Canal undertaking, as it is deemed unnecessary to take them separately, as the net revenue is already known. The estimate for the Ship Canal and docks is £804,200.

The most interesting figures are given respecting the estimated trade and revenue of the canal. It is stated that a traffic of not more than 3,000,000 tons of general goods would give—In canal tolls (half the existing railway rates) and in wharfage (half the existing dock and town dues upon goods) at least £750,000, with ship dues (less than those charged at Liverpool) £75,000. These two sums, together with £60,000 as the net income of the Bridgwater Canal undertaking, amount to £885,000, from which, after deducting £104,200 for working expenses, and £72,000 as interest at 4 per cent. upon £1,800,000, leaves a net income of £709,000, which, if ship dues are charged, is sufficient to pay a dividend of 8 per cent. upon the entire share capital of the company, or if these dues are not charged a dividend exceeding 7 per cent. upon a similar capital, and in either case to carry £69,000 a year to a reserve fund.

This small estimate neither includes any revenue from coastwise traffic or from low class traffic as coal, salt, and iron ore, for which, at different points of the waterway, separate accommodation is provided, and a very moderate shipment of this traffic would greatly increase the net income. Nor does the estimate referred to consist of any revenue for porterage and other sources, which are chargeable to shippers under the Company's statute at actual cost, with the addition of 10 per cent. for profit to the company. "The total traffic in and out of the port

of Liverpool amounts to upwards of 15,000,000 tons of cargo. The amount of traffic included in the above estimate is, in fact, less than the estimated increase during the past four years of the trade of the district which can be served by the canal, and it is therefore reasonable to expect that before the canal works can be completed the increase of the trade of the district will be sufficient to furnish a remunerative traffic to the Ship Canal without removing existing trade from any other port. The directors are satisfied that a much larger quantity of traffic will use the Ship Canal, and the traffic expected was described in great detail in the tables placed before the Parliamentary Committees of 1884 and 1885. They showed a probable traffic in various specified articles, including coastwise low class goods, and local trade at the end of seven years, amounting to 9,649,316 tons." This amount of traffic will yield a net income of £1,571,905, sufficient to pay a dividend of 18 per cent. upon the whole capital of the Company, and to accumulate a reserve fund at the rate of £131,905 per annum.

According to population the proportion of our shipping trade which could be allocated to the canal as the nearest port is 21,000,000 tons at the least. Although it has been pointed out that for revenue purposes it is not necessary to transport more than 3,000,000 tons of cargo on the canal, it should be remembered (*a*) That the district of which Manchester is the centre supplies in value two-thirds of the exports of the United Kingdom; (*b*) That this district is almost entirely dependent for its supply of food upon other parts of the United Kingdom or abroad, must absorb "a far greater proportion of the imports and of coasting traffic than its share *pro rata* averaged according to its proportion of the entire population of the country;" (*c*) That the shipping trade using the ports of this country amount to about three tons of the cargo per head of the population.

The directors, who are thoroughly convinced of the soundness of the scheme, founded upon practical experience of the trades and requirements of the district, and a careful examination of all the facts and circumstances bearing upon the case, confidently recommend the shares for the following among other reasons:—"To investors because they are satisfied that the undertaking will prove a sound and remunerative and improving investment; and to all who are engaged or in any way interested in the trade of the district or in that of the country in general, because the canal will tend largely to revive and develop trade." Upon all the capital which it will be necessary to call up during the first twelve months the directors will be able to pay interest at the rate of 3 per cent. per annum out of the revenue of the Bridgwater Canal undertaking. They will also in due course deposit in the Private Bill Office of Parliament a Bill to enable the Company to pay interest out of capital, and it will be for the shareholders to declare whether the Bill be proceeded with. The directors are satisfied that powers can be obtained if the shareholders desire them to pay interest at the rate of 4 per cent. upon the entire capital during the remaining time of construction.

The Canal Company, which was incorporated by Act of Parliament which received the Royal Assent in August last, has an authorised share capital of £8,000,000, and borrowing powers of £2,000,000. The issue of the share capital is in 800,000 shares of £10 each, and the price of issue par or £10 per share, payable 10s. per share on application, and 10s. per share on allotment, and the remainder by instalments at such times as may be necessary, but at intervals of not less than three months, and by calls of not more than £1 each or not exceeding £2 10s. in any twelve months. Interest at £5 per cent. per annum will be payable on all sums paid up upon shares which from time to time shall be in advance of the sums called up, while payments in full or in advance may be made on allotment or at any time afterwards, subject to the withdrawal of the option by the Company. The liability of a shareholder is limited to the amount remaining unpaid upon his shares.

Mr. Adamson states that about 10,000 navvies will probably commence the construction of the canal early next year, and we have every reason to believe that such rapid progress will be made with the undertaking that it will be completed in four years.

THE MONT DORE OF BOURNEMOUTH.—The salt water supply for this building is obtained by a set of highly finished Merryweather Sea Water Pumps, driven by a gas engine. The water is drawn through specially coated pipes laid 500 feet out at sea, and some 4,000 feet of suction pipe are employed. The fire extinguishing appliances at the above building are similar to those supplied by the same firm to the Hotel Métropole, and Langham Hotel, London.

TELEPHONING FROM LIGHTSHIPS.

AN experiment of the greatest importance to the commercial world, writes a correspondent of the *Times*, is now being made on the East Coast of England by the Telegraph Construction and Maintenance Company. For the last eight months the company has had several of its best operatives located in the neighbourhood of the Naze, off which the most dangerous sands round England are to be found. These gentlemen are hourly in communication by telephone with a lightship which is anchored 10 miles out in the vicinity of the Swin passage. An ordinary telegraph cable has been laid from Walton-on-the-Naze to the Sunk Lightship, and telephone and telegraphic apparatus have been affixed to both ends. It was considered improbable that the human voice would be conducted 10 miles, especially in rough weather; but this has been now proved to be thoroughly practicable. A conversation was carried on with Mr. Stevenson, one of the Telegraph Maintenance Company's officials (who was on board the Sunk Lightship), by telephone for a considerable time. Mr. Stevenson had been a month upon the boat, and had experienced all kinds of weather, during which time he had kept Mr. Lewis and Mr. Pinkerton, his colleagues on shore, fully informed of the state of the weather, roughness of the sea, and passing craft, adding frequently forecasts of weather, which usually turned out to be correct. A month upon the lightship is a trying ordeal; but Mr. Stevenson was so satisfied with the success that attended the experiment, and knowing, if the advantage of telephonic communication with lightships was understood and generally adopted, what a splendid boon it would be to mariners and merchants, that he spent his time busily in collecting information and watching the working of his electrical machines. In a back room of the Walton Post-office are machines for utilising magnetic currents of all descriptions. A button is touched, which rings a bell in Mr. Stevenson's cabin upon the Sunk Lighthouse 10 miles away; then a voice—that of Mr. Stevenson—is heard inquiring what is wanted. "How is the wind?" "How is the tide?" "Have you seen such and such a ship pass?" "How much water is there in the Swin Passage?" These questions can be answered at once.

Of much more importance is the use the telephone could be put to in a storm or in the case of a ship getting on the sands. One night this year, in a rough sea, a ship did get on a sandbank, and instantly her exact position was telephoned to Walton from the lightship. The gentlemen at Walton awoke the lifeboat crew and telegraphed to Ramsgate and Harwich, where the lifeboats were got ready for launching. Just as all three lifeboats were about to start, a telephone message came from the lightship that the ship in distress had got safely off the sandbank, and that there was no need for the lifeboats to start. The boats were stopped, and if it had not been for the telephone they would have been out on the rough sea all night searching for the ship that sent up distress signals. If all the lightships around the coast of Europe had this means of communication to point out the exact position of a ship in distress, a great number of lives would be saved, as the position of many ships foundering cannot be indicated with any certainty by the ordinary rocket signals. Besides the above uses of the telephone with lightships, all passing ships in quest of a pilot to navigate them through dangerous channels, could without difficulty, telephone their designs to shore. The Sunk Lightship is only 150 tons, and yet only once in the stormiest sea, when she had been tossed about in a gale of wind, has the telegraph wire been broken. The two ends at the break were picked up and rejoined within 24 hours. She is moored in 10 fathoms of water, and is manned by a captain and six to eight men, all of whom express their most earnest approval of the intercommunication with the shore, whereby they can make known at once their own and the wants of others. During the night communication is as open as in the day. The Trinity Board is showing considerable interest in the experiment, and it is hoped that it will see the great importance of at once putting by this means the chief lightships in communication with the shore. It is stated by the gentlemen engaged at Walton that the telephone will act over twice ten miles; and there is no reason why some day it should not act over much greater distances.

THE *Novosti* states that it has been decided to construct, as speedily as possible, four more steel cruisers for the Baltic fleet, and three large ironclads for the Black Sea fleet as soon as three ironclads of about 10,000 tons each are launched, which are now being built in the dockyards of Sebastopol and Nicolaieff.

THE CLEMENTS-NOBLE PATENT SELF-ACTING SIGHT-FEED LUBRICATOR.

As will be seen from our illustration of this lubricator, which combines all the advantages of the well-known "Clements" Patent Lubricator, with a simple and efficient sight feed, it has only one connection to be made instead of two, as with all other sight feed lubricators. It will also be noticed that it has not any of the usual condensing coils or other cumbersome accessories, the feed being entirely due to gravity and not dependent upon any other adventitious aids; and it is thus easily started and capable of a fine regulation.

Referring now to the illustration it will be seen that in addition to the sight feed glass E F, the oil container A

THE CLEMENTS-NOBLE PATENT SELF-ACTING SIGHT-FEED LUBRICATOR.

is provided with a gauge glass K by which its contents can be noted.

The lubricator is fixed by screwing the outlet H into either the steam pipe or steam chest, the admission of steam being controlled by the valve I, and the flow of oil which enters at the cup and valve J by the regulating valve D. The course of the oil through E F, and the oil passage G to the outlet H is well-indicated by the arrows.

The vent valve B, together with a similar valve at the bottom of the glass K admits of the lubricator being thoroughly blown through and cleaned.

The sole makers, Messrs. Llewellins & James, of Castle Green, Bristol, have supplied these lubricators to every navy and to the principal steamship companies throughout the world.

INTERNATIONAL EXHIBITION OF NAVIGATION, TRAVELLING, COMMERCE, AND MANUFACTURE, LIVERPOOL, 1886.

An exhibition, well defined by its title, and under the patronage of the Queen, will be held in Liverpool during the year 1886.

Having as its President, H.R.H. the Prince of Wales, and as its object the illustration of the history and development of travelling by land, sea, and air, we heartily wish it, and need scarcely prophesy for it, every success.

The exhibition will be opened in May of next year, upon a site known as the Edge Lane Hall Estate, adjoining Wavertree Park, and covering 35 acres of ground. It is conveniently situated for affording ready means of access to visitors by rail, and possesses special facilities for the delivery of materials and exhibits.

The exhibits representative of the manufactures and commerce of the world, will, we are sure, be on a most comprehensive and exhaustive scale, nor need we fear that Liverpool, the second seaport town in the world, will be behindhand in making her exhibition perfect, in so far as all that relates to navigation is concerned; in fact, we see from the prospectus before us, that this branch of the exhibition will include a collection of models of vessels, ancient and modern, together with illustrations of the modes and materials of their construction, their engineering and other appliances, boats of every description, docks, harbours, lighthouses, life-saving apparatus, and all other matters connected with travelling by water.

In the department of land travelling there will be exhibited chariots, coaches, and carriages, of all countries and all times; the history of steam as a motive power will be fully illustrated by numerous models both English and foreign. In addition to the highly interesting collections contained within its "walls" (if we may be allowed the word), the exhibition will be a centre of attraction to the pleasure seeker as well as to the student seeking information, for it has been decided to introduce at Liverpool all the successful features, namely, bands, fountains, electric illuminations, concerts, &c., of the South Kensington shows.

The Mayor of Liverpool (David Radcliffe, Esq.), is chairman, with Messrs. Henry B. Bone, as secretary, and Samuel Lee Bapty as general superintendent of British Exhibits, the offices being at A11, Exchange buildings, Liverpool.

CLYDEBANK SCHOLARSHIP IN NAVAL ARCHITECTURE.—The following extract from the Glasgow University Calendar will be found of interest: "Clydebank Scholarship.—Founded in 1885 by Messrs. James and George Thompson, engineers and shipbuilders, Clydebank. The endowment is in the meantime for six years, but will be made permanent should the experiment be successful. Value, 10*l.* per annum. The scholarship is to be competed for biennially, at such times as the Senate may appoint, by young men not under eighteen years of age, who have been employed at least three years as working apprentices, or in the drawing offices of shipbuilding or engineering works situated in the district of Clydebank, Yorker, or Dalmuir. The examinations will be held at the commencement of the winter sessions 1885-6, 1887-8, and 1889-90. The successful candidate must attend during the two years for which it is tenable the course of lectures and of instruction in ship drawing and calculations given by the Professor of Naval Architecture. Names of candidates to be given to the assistant clerk of Senate on 1st October."

GOSLIN & STOKER'S PATENT DUPLEX BELL BUOY, WITH HARRISON'S PATENT SOUNDING APPARATUS.

NO doubt it will be interesting to our readers to know that a preliminary trial of Goslin & Stoker's Patent Duplex Bell-Buoy, with Harrison's Patent Sounding Apparatus, was made on Friday, October 9th, off Trinity Buoy Wharf, at Blackwall.

A model of this buoy, and of another bell-buoy, has been and is exhibited at the International Inventions Exhibition, and has been awarded a bronze medal.

The trial which took place on Friday was admitted, by some of the observers, to be so conclusive, as to show that it is far in advance of other bell-buoys which have been seen during the last 35 years.

The trial took place in the presence of Admiral McClintock, Captains Ladds and Barlow of the Elder Brethren Light Committee of the Trinity House.

When the buoy was placed in the water about half an hour before the flood it was continually ringing, both by the tidal motion and by the wave motion in the river; the wind being against the tide, caused but a mere cockle, yet this was sufficient to keep perpetual sounding. At the flood, or slack water, the sounding properties were not entirely stopped, and at the ebb tide, when the Light Committee came to see the buoy at the wharf, and when there was no wave motion, the bell was being struck about 14 blows per minute by the tidal current, which was not very strong.

The object of this invention is to provide a bell-buoy which shall by the tidal current give warning in time of calm, or fogs, when there is no wave motion to produce a sound, as is requisite with all ordinary bell-buoys, and as those heretofore made.

At the same time the buoy is provided with Harrison's Patent Sounding Apparatus, which consists of a rolling ball upon a table, upon which there are certain deflectors, to cannon off the ball towards the edges of a large hemispherical bell or gong, with a slight motion of the wave.

The form of this patent buoy is somewhat different from those heretofore adopted, consisting of a pair of steel cylinders coupled together, which present a long surface to the tide or waves, with an arrangement underneath of a fan, or vertical turbine working in a submerged cylinder, which, acting with cams upon a long lever, strikes the bell or gong on the outside at certain intervals.

The buoy is brought up to the surface by a rudder submerged, and is flanged upon the top of the water as canted from end to end by the waves, the result being, with a wave motion, that there is a continuous deep sounding hum and ringing.

The sound of this bell-buoy has been distinctly heard between four and five miles distance, when placed in a creek on the Essex coast.

The buoy in its performance on Friday acted in every way satisfactory under the conditions in which it was placed.

The Light Committee propose to examine its construction carefully, and to have a further trial under other circumstances.

The sounding has been found by trial to be constant at all times where there is a flow of tide, whether in calm or with wave motion, excepting perhaps a period of about three or four minutes at the turn of the tide.

Now that the Elder Brethren of the Trinity Corporation are about establishing a new system of buoyage, no doubt this plan of cylindrical buoys will be found advantageous, not only for bell-buoys, but for other similar purposes. The buoy has another distinctive feature that it bears over the bell, or gong, and between the bell and the cage, a cylinder of glass, coated inside with luminous paint, which has been seen distinctly a distance of some miles when at sea.

MESSRS. BELL & SON'S ASBESTOS AT THE INVENTIONS' EXHIBITION.

THIS Firm, in addition to a very comprehensive display of their numerous manufactured products, show in operation some of the machinery employed by them for the spinning and weaving of the crude material. The limited space at their disposal would not allow the firm to show in actual operation anything but the preliminary stages employed in the preparation of the various textile fabrics produced from asbestos, and they are thus prevented from exhibiting the opening and cleaning of the crude fibre, which is accomplished by a series of operations for each of which the firm have designed and constructed special machinery.

The machinery now exhibited comprises a condensing carding engine, in which the formation of the sliver is shown, the conversion of this into yarn being effected in two small spinning frames. The "doubler" prepares the yarn for the loom, on which pure asbestos cloth, 40 inches wide, is made.

It is due to this Firm to state that they first produced, in 1879, pure asbestos yarn as an article of commerce, the perfectly smooth nature of the surface of the fibre preventing the spinning of asbestos hithertofore without an admixture of vegetable or other fibre.

Amongst the latest developments in asbestos shown we notice the "Asbestos Metallic and India-rubber Woven Sheeting." This is a fabric composed partly of finely-spun asbestos yarn and partly of fine wire, made from a suitable alloy, which, by imparting great tensile strength, renders the material capable of resisting the highest pressures yet attained; the same material is also shown in the form of a woven tape for cylinder covers, manhole and mudhole joints, &c., and in woven rings and washers; asbestos metallic cloth packing is also shown.

"Bell's Asbestos Lubricant" is produced by submitting oil to a process of refining by means of asbestos, and by which means the oil is purified and enriched.

"Bell's Asbestoline" is made in the form of a paste by amalgamating asbestos with some of the best lubricating substances that can be brought into harmony with each other; it is prepared in three degrees of consistency, the hardest being for use in tropical climates.

Some very fine specimens of crude asbestos are shown, including samples from South Africa, Russia, the North of Italy, and Quebec, and it is to the discrimination exercised by this Firm in obtaining the best asbestos discoverable in various countries, and to their uniform success in discovering the right fibre for the work to be done, that their brand is now recognised throughout the world as a guarantee of first-rate quality.

MESSRS. T. RICHARDSON & SONS' TRIPLE EXPANSION ENGINES.

WE have the pleasure of presenting to our readers a pair of plates, from photo's, of a Triple-Expansion Engine by the above well-known firm.

Plate I. is a view obtained from the starting platform and shows the front of the engines, starting gear, steam gauges, &c.

Plate II. shows the back of the engines, position and arrangement of steam chests, pumps, and reversing engine, and also illustrates the valve gear; the latter is the patent of R. Wyllie, Esq., manager to the builders.

The sketches show more clearly the cylinder arrangement, which varies so much with different makers of this class of engines, and also the valve and reversing gear.

Fig. 1 is a plan of the cylinders and steam chests.

occupies rather less space in the slip than a compound engine of equal power, with two cylinders and the steam chests in the usual positions.

The piston rods, which are of steel, are not through rods, and the cylinder relief valves are placed on the centre of the covers. The cylinders are supported by three cast-iron columns at the back, and three polished wrought-iron columns at the front. This leaves a very clear open front, rendering all the main bearings, connecting rod brasses, valve gear, and guides easily accessible for overhauling and repairing. The connecting rods are of wrought-iron with steel pins, and their length from centre to centre is 6 ft. 6 in. The high-pressure piston rod and valve spindle are packed with Morison's patent asbestos metallic packing, specially made for high pressures by the Triple Packing Company, at their works at Hartlepool, and are found to run perfectly tight and to give no trouble whatever.

The condenser, air-circulating and bilge pump chamber,

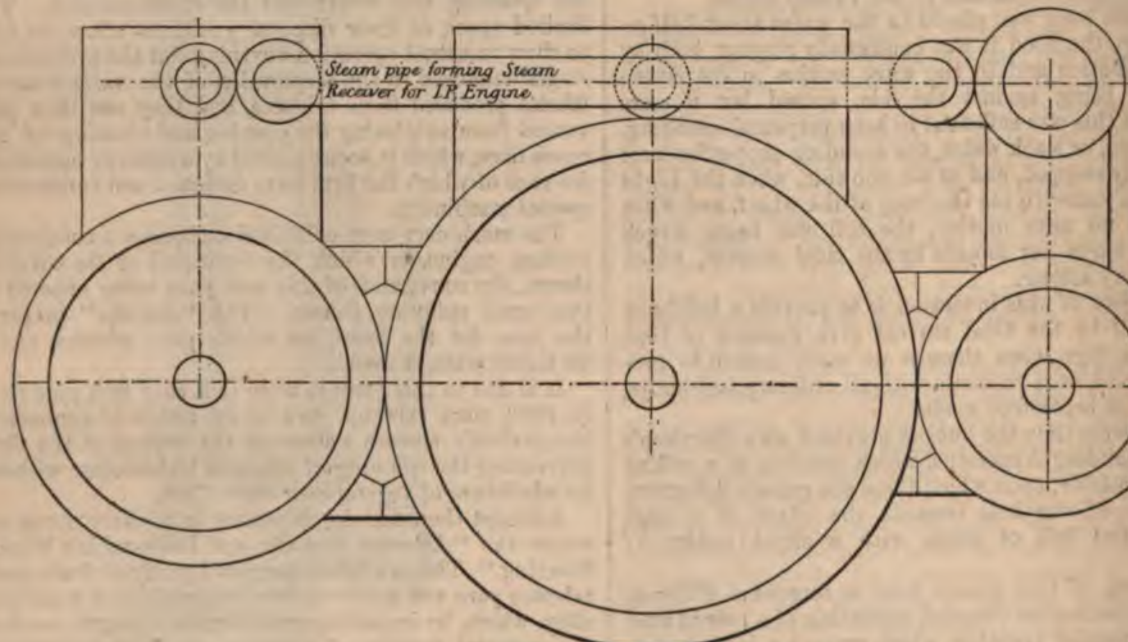


FIG. 1.—MESSRS. T. RICHARDSON & SONS' TRIPLE EXPANSION ENGINES.

The diameters are 21 in., 35 in., and 57 in., and the stroke is 36 in.

It will be noticed that the high pressure is the forward engine; the intermediate pressure is the after engine, while the low pressure is placed between them.

The steam from the H.P. exhaust passes through a copper pipe—(not shown in the plates)—which also forms a steam receiver—to the I.P. steam chest.

The working surfaces of the cylinders are cast separately of hard close-grained cast-iron.

All the cylinders are steam jacketed and covered with non-conducting cement and lagging.

The steam chests are placed at the back or port side, over the condenser; the H.P. is provided with a piston valve; the other two have ordinary flat slide valves. By this arrangement of the cylinders the engines are brought as close together, fore and aft, as the cylinder covers will allow. The result is that the whole engine

three back columns, and main bearings, are made in only two large castings, which are firmly held together by a large number of $1\frac{1}{8}$-in. bolts, carefully fitted into rimed holes, so that a very large portion of the engine becomes practically one large casting, rendering the whole very solid and firm.

The condenser—the shape of which is shown in the Plates—contains about 500 solid drawn brass tubes $\frac{3}{4}$ in. in diameter, which pass through Muntz metal tube plates at each end, and are kept tight by cotton packing and screwed glands, forming so many stuffing-boxes. This plan, though rather expensive to the builders, makes a very complete job, and seldom requires any attention; the tubes are supported in the middle of their length by passing through a cast-iron tube plate. A vacuum of 28 in. can be maintained with this condenser. The circulating pump is double-acting, with a plain piston-bucket, which is a good working fit in the chamber, and

requires no packing. The pumps are worked by levers from the after or intermediate pressure engine. The air and circulating pumps are immediately behind the condenser, and their rods pass through the pump-crosshead, which has a small crosshead fitted on its fore-end to work the feed-pumps, while an arm on the port side of it works the bilge pumps. The air-pump rod is prolonged above the crosshead, and passes through a brass bush which forms a guide to steady all the pumps.

The crank-shaft is made in three separate parts, exact duplicates, so that they are interchangeable. The angle of the cranks is 120 degrees.

The main bearings are formed by strong cast-iron bushes filled with Parson's white brass, and the pressure per square inch on the bearing surface is less than has been the practice with the ordinary compound engine. Some of the triple expansion engines by this firm, which have now been running for over eighteen months at 100 revolutions per minute, have not, up to the present, required the main bearings readjusted.

As shown in Plate I., there are six gauges, arranged in pairs, on the three front columns, showing the pressure in, 1st, the boilers; 2nd, the I.P. steam chest; 3rd, the L.P. steam chest; 4th, the I.P. jacket; 5th, the L.P. jacket; 6th, the vacuum in the condenser. The following are the pressures usually shown: 150 lbs., 45 lbs., 10 lbs., 80 lbs., 15 lbs., and 26 ins. The steam jackets are drained through copper pipes having small valves, placed on the back of the condenser, by means of which, and the steam cocks, the pressures in the jackets can be regulated to the pressures given above. There is no water gauge on the jackets, but a small cock on the drain pipe of each enables the engineer to ascertain whether steam or water is passing through the pipes, and so prevent the waste of steam.

The thrust-block is placed just inside the tunnel, and consists of a strong cast-iron chest, with seven horseshoe collars, each ajustable by brass nuts on two strong Muntz-metal bars, which pass along each side, and are screwed the whole of their length, and secured at each end to the chest. The working surfaces are of Parson's white brass. The thrust-block does not in any way form a bearing to the shaft. Starting, stopping, and reversing are effected by means of a small direct-acting engine, having a steam cylinder and a water cylinder. One piston rod passes through both cylinders, and is attached direct to the reversing gear; this piston rod also forms a rack on which the hand-reversing gear works when required. The object of the water cylinder is to prevent the too sudden action of the steam cylinder, and only allow reversing at a steady pace. The reversing engine is placed at the back of the engines, and connected by a rod to the hand-lever at the front. The action of this reversing engine is both quick and steady; it shuts off its own steam, and leaves the reversing gear in a position agreeing exactly with that in which the reversing lever may be placed; thus, if the lever is put right over a-head, the gear at once goes over into full gear; if then the lever is put back an inch the reversing gear goes a proportionate distance back, shuts off its own steam, and remains there, and so in any other position of the reversing lever rendering the engines very handy.

An auxiliary starting valve is attached to the L.P. engine, but when a vacuum has been formed in the condenser it is unnecessary to use it.

As previously stated, Plate II. shows the valve gear, but as this gear is a leading feature in these engines, being an improved design of the single eccentric dynamic type, correcting the most serious objections and defects in previous designs on this principle, and is especially suitable for triple marine engines, as it allows the engine-room to be reduced to a minimum, without increased complication or crowding of parts, we give a separate diagram (Fig. 2) to illustrate its action more clearly than can be done in the plates. Referring then to Fig. 2, which shows the arrangement of the valve gear as seen when standing aft and looking forward, the eccentric

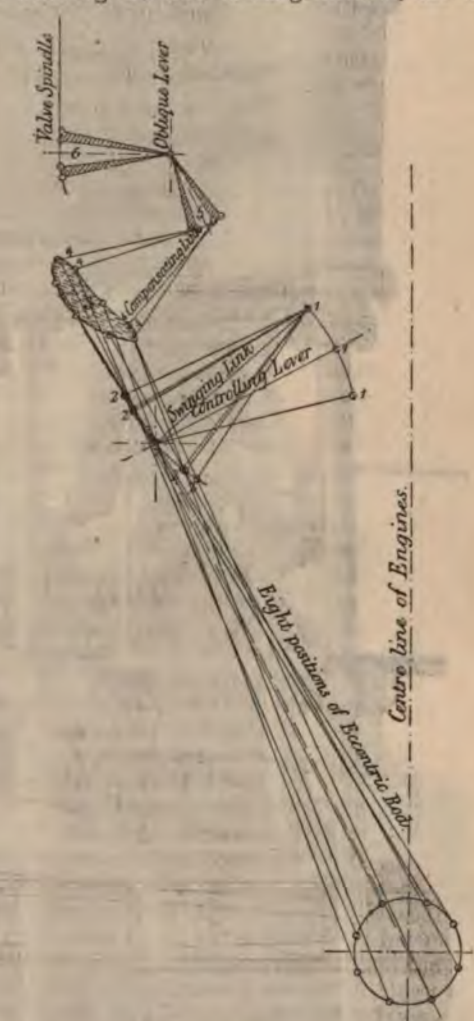
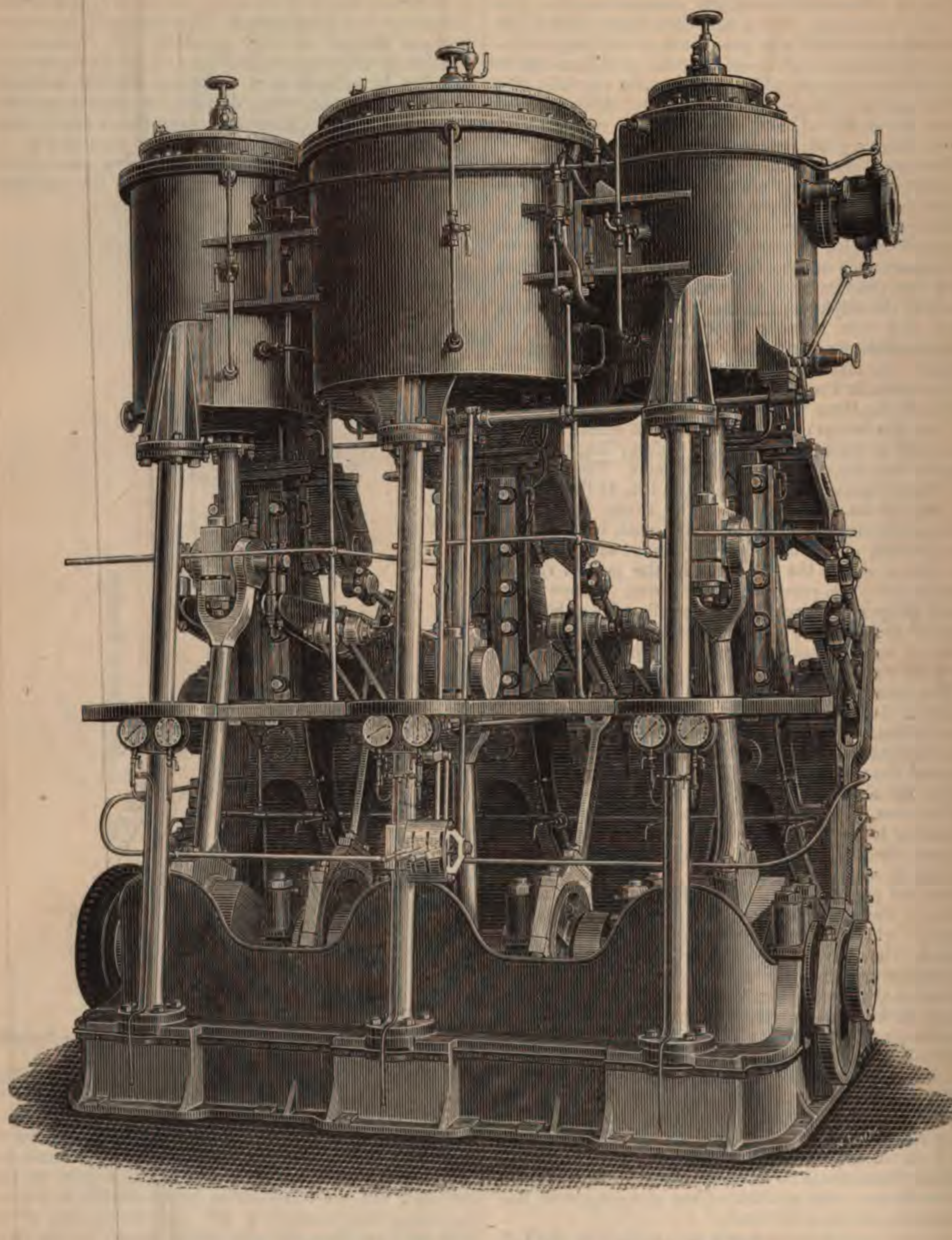


Fig. 2.

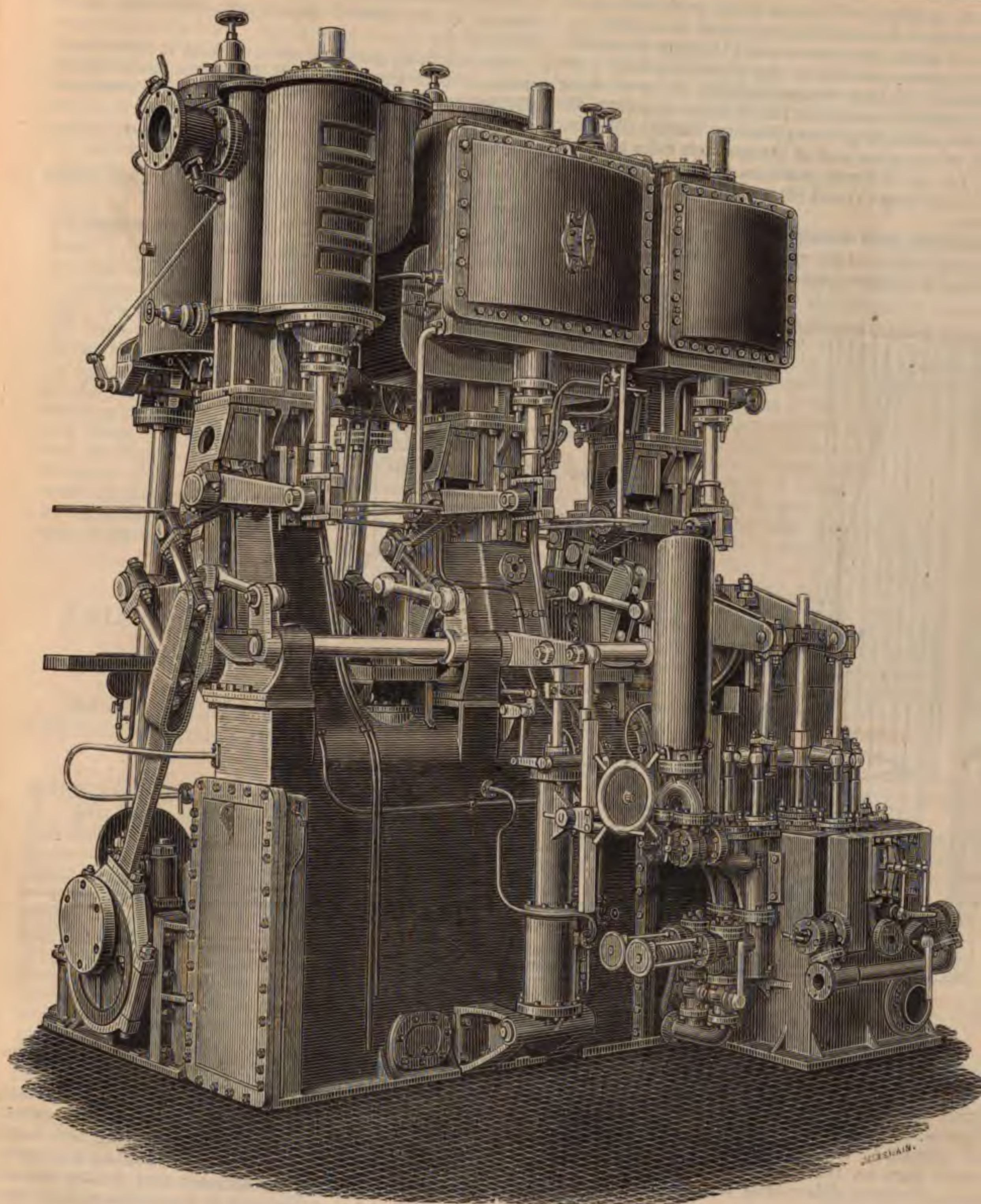
Messrs. T. Richardson and Sons' Triple Expansion Engines.

rod is placed diagonally over the condenser and is guided in an arc of a circle, which is effected by suspending it by a link, centred on a pin which is adjustable into various positions for making the engines go ahead or astern, or for altering the cut-off. The movements for working the valve are transmitted from a joint on the eccentric rod, the transmission being effected by a compensating link connecting the joint to an arm of an oblique lever, the other arm being jointed to the valve spindle. This compensating link is an essential and distinguishing feature of this valve gear, it being placed and proportioned relatively to the other parts, in a



MESSRS. T. RICHARDSON & SONS' TRIPLE EXPANSION ENGINES.

PLATE I.



MESSRS. T. RICHARDSON AND SONS' TRIPLE EXPANSION ENGINES.

PLATE IV.

manner to produce, with equal leads, practically equal port-openings and cuts-off at each end of the stroke.

In the diagram, the lines marked (1) show the middle and two extreme positions of the controlling lever; the lines marked (2) show various positions of the swinging link, by which the eccentric rod is suspended from the end of the controlling lever; the oval marked (3) being the path of the upper end of the eccentric rod; the lines marked (4) are different positions of the compensating link, and the lines (5) and (6) corresponding positions of the levers.

The shaded parts correspond to the port openings at the top and bottom of the cylinder and indicate the practical equality of these openings.

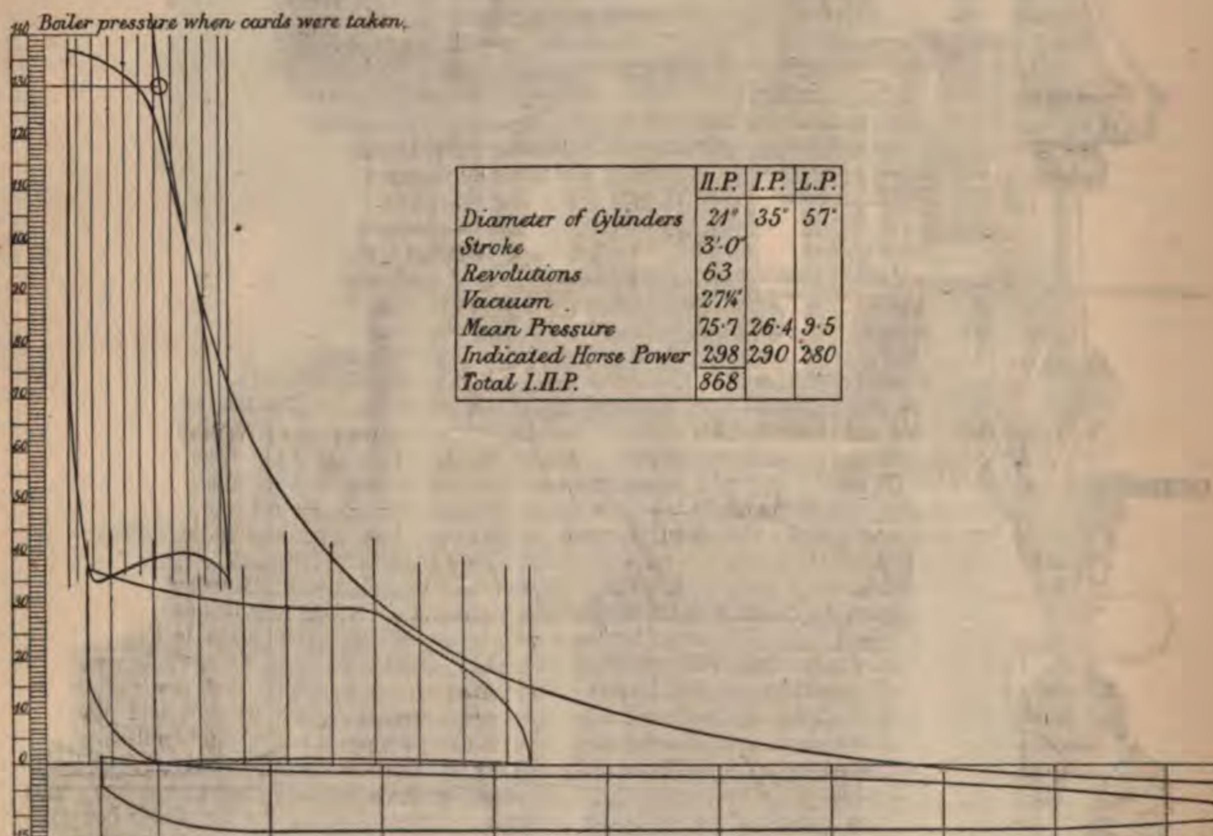
If we calculate the nominal horse-power of these engines at 30 circular inches we find them to be 164 N.H.P.

The I.H.P. is, therefore, when working at this reduced pressure, 5·29 times the N.H.P., and is pretty equally divided between the three cylinders; this is even more apparent when working at full pressure.

The consumption is stated by the builders not to exceed 1·5 lb. per I.H.P. per hour.

Steam is generated in two single-ended steel boilers 13 ft. 6 in. diameter and 9 ft. 6 in. long.

Each boiler has two of Fox's patent corrugated furnaces 6 ft. long and 3 ft. 7 in. mean diameter.



	H.P.	I.P.	L.P.
Diameter of Cylinders	21"	35"	57"
Stroke	3'-0"		
Revolutions	63		
Vacuum	27¼"		
Mean Pressure	75·7	26·4	9·5
Indicated Horse Power	298	290	280
Total I.H.P.	868		

Fig. 3.

Messrs. T. Richardson and Sons' Triple Expansion Engines.

All the joints of this gear is fitted with simple and convenient brass bushes and bolts, so that they are easily adjusted. The valve spindle ends resemble the piston rod crosshead, having slipper guides which work on motion bars on the back of the columns; the brass bushes, however, slide a little to suit the motion of the oblique lever.

Fig. 3 is a set of indicator cards compared with the theoretical card. It will be noticed that the initial pressure in the H.P. cylinder comes very near the boiler pressure, and also that there is practically no loss between the H.P. and I.P., and between the I.P. and L.P. respectively.

The firegrate is 5 ft. 9 in. long, and each furnace has a separate combustion chamber.

The working pressure is 150 lbs., and the boilers are tested to 300 lbs. per square inch by hydraulic pressure. Pipes and valves are provided for pumping the water from the bottom of the boilers, and delivering it in again at the water level by the ordinary feed donkey, and so perfectly circulating the water in the boilers while raising steam; this is also intended to be used at sea to guarantee the removal of stagnant water from the bottom of the boilers, but difficulty is sometimes experienced in getting the donkey to pump when under full pressure. While raising steam, however, it is found that with this arrange-

ment the boilers warm very evenly. The longitudinal seams have double-butt straps and three rows of rivets on each side of the butt. Machine riveting is applied as far as possible. The shell plates are flanged to meet the end plates and are welded at the corners. The seams round the furnace mouths are turned outwards and so kept clear of the fires.

Each furnace has two small doors, so that the fires can be spread very evenly, and the clinker removed with only one door open at a time; but the principal object of the two doors is to keep the fires always bright by firing at alternate sides, allowing one side to burn through before firing the other. These boilers are found to generate a sufficient supply of steam without being pressed, or the fires much worked.

A steam-reducing valve is provided for supplying steam from the main boilers to the winches and steering-gear. We have endeavoured throughout this article to give a correct account of these engines; to confine ourselves, as far as possible, to a description of the engines and boilers as they are at present produced by the firm named, noticing principally those points where makers differ, and where recent improvements have been introduced, and we hope to have the pleasure of giving similar accounts of the Triple Expansion Engines of other north-country engineers, which we have no doubt will be interesting to readers at the present time, when this type of engine is coming so prominently forward.

International Inventions Exhibition.

MESSRS. SELIG, SONNENTHAL & CO.'S EXHIBIT AT THE INVENTIONS EXHIBITION.

THIS well-known firm, of 85, Queen Victoria-street, E.C., have a very good display of machine tools at their stall (No. 1,216) in the Western Annexe. Amongst the tools we noticed is the patent Self-acting Band Saw Filing Machine, which we fully described and illustrated in our issue of January last. This handy tool, which propels the saw and sharpens it at the same time, is shown in motion. Another machine, which could not but prove useful in the engine room, is a Treadle Planing Machine, yclept the "Eureka." The machine can be fitted to run either by hand, treadle, or power, and is made in three sizes, the smallest to plane 22 in. long, 13 in. wide, and 8½ in. high, while the largest takes 40 in. by 18 in. by 16 in. The "Eureka" works continuously in one direction, is fitted with reversing motion, and has a practical disengaging motion which admits of the work being stopped instantly, even when reversing. Another tool, shown here for the first time, is a patent Screw Lathe, fitted with clutch, back gear, chasing apparatus, self-acting feed for milling, and longitudinal feed for the cut-off rest. The lathe is made in two sizes capable of turning out screws from 1 in. to 1¾ in. diameter, and from 1 in. to 2 in. diameter respectively. The special features of this tool are a self-acting revolving turret, and an automatic feed with an adjustable automatic stop.

Among other exhibits of this firm likely to interest our readers, we noticed specimens of the "Zanite" emery wheels, Sonnenthal's stay-bolt cropper, and his internal boiler-tube cutter, Selig's patent screw and roller tube expanders, an adjustable pipe wrench, Selig's patent tube-plate cutter, Christoffel's patent elliptic adjustable tube scraper, and some fine samples of the well-known "Cleveland" twist drills.

PORTABLE TIDE-RECORDING MACHINE.

As much attention now is paid to accurate scientific observations of the rise and fall of tides, or the rise and fall of water in wells, or to the depth of water falling over gauge weirs, to guide engineers in their professional work depending upon these subjects, any instrument promising special accuracy in the register of these subjects merits attention. The tide-recording machine we are about to describe is the invention of Mr. Baldwin Latham, and consists of a drum which is driven once round in twenty-four hours, with a suitable clock arrangement to indicate the time. As pendulum clocks are not reliable for work on wooden piers subject to vibration, the clock in this case is controlled by a balance wheel and lever escapement. The level of the water is indicated by a float, the float being attached to a wire cord, which is securely fixed to the drum. The float, in its descent, acts upon a spring winding it up, so that as the float rises the spring again picks up the slack cord. In order to render the strain of the spring uniform, the well-known fuzee arrangement is introduced between the spring and the float. The drum, operated by a movement of the float, carries a pinion which actuates a marking pencil by a rack. There are four different-size pinions provided with the machine, so as to produce diagrams to four different scales, as desired. The pencils for recording are arranged by a parallel motion, so that as the pencil point wears away the pencil is pressed forward without any alteration of its correct position on the diagram.

The drum travels upon a screwed spindle, so that the cord shall always pass on and off in a perpendicular line: this prevents error from the lengthening and shortening of the cord, which would ensue were the drum a fixture and the cord spindle drawn off the drum on varying angles. The apparatus is thus very simple, portable, and self-containing, so that it can be easily fixed in a few minutes in any position in which it is required to work. This instrument has already been used in a very large number of tidal observations by the inventor on behalf of the Corporation of the City of London, so that its merits have been well proved. The machines are manufactured by Mr. Joshua Richmond, of Church-road, Islington, who exhibits a sample of the machine in the International Inventions Exhibition, the workmanship and finish of the machine being very creditable to the maker.

MODELS OF SHIPS AND ENGINES AT THE INTERNATIONAL INVENTIONS EXHIBITION.

PERHAPS no more conclusive evidence of the gigantic strides made during comparatively recent years in the kindred sciences of naval architecture and marine engineering, could be obtained than is furnished by a

careful inspection of the various models, sections, and photographs shown in Group VII. at the Inventions Exhibition, commencing with the exhibit made by the Lords Commissioners of the Admiralty at No. 921, we find models of the following of Her Majesty's ships:—*Inflexible, Devastation, Monarch, Rupert, Glatton, Opal*, and *Staunch.* We must candidly confess to a feeling of deep disappointment at the meagreness of this display, considering that it is made by those whom are supposed to represent the naval supremacy of the world.

The Barrow Shipbuilding Company, Limited, of Barrow-in-Furness, exhibit at Stand No. 928, some very fine half models of ships.

Messrs. Laird Brothers, of Birkenhead, No. 930, have a collection of models and photographs, which from an historical point of view, possess especial interest, illustrating as they do the progress made in paddle-wheel Channel mail steamers since 1840, and in screw mail steamers since 1852, and sundry models and photographs of early iron steamers.

One of these photographs shows a paddle-steamer, high and dry, in such a position as would, we think, terribly alarm some of our modern naval architects.

Sir W. G. Armstrong, Mitchell & Co., Limited, have at the next stand (No. 931) the finest and most numerous exhibit in this group, comprising as it does upwards of 40 models representing vessels from 90 tons displacement (steel paddle steamer *Oput*) to 9,000 tons displacement (twin screw cable steamer *Faraday*). It may be interesting to here mention, as showing the rapidity with which work can now be executed, that this Firm launched the cable steamer *Silvertown*, of about the same tonnage as the *Faraday*, in the extraordinary short space of 100 working days from the time the keel was laid, and entirely finished her in seven months from the date of order. They also exhibit a photograph and full model of a floating dock, built in 1877, for the Dutch Government service.

The White Star Line, exhibit, at 932, one of the best finished and most complete models that we have ever had the pleasure of examining. It represents one of their famous Atlantic passenger steamers, well named "floating palaces," and shows in a marked degree the amount of attention that has been paid to everything likely to conduce to the safety and comfort of the Atlantic passenger.

The Thames Ironworks and Shipbuilding Company, Limited, have also a very interesting display at No. 933, two of their models, representing the *Warrior* and the *Benbow*, show ironclads of the earliest and latest types, and if a general appearance of bulkiness is any criterion as to fighting qualities, then we should say that the latter vessel must be a great and welcome addition to our navy.

The Royal National Lifeboat Institution show, at No. 937, models of their improved self-righting lifeboats.

Messrs. Samuda Brothers, of Poplar, have very fine models at Stand No. 940, of the celebrated *Riachuelo*, armour-clad turret ship, and the *Mary Beatrice* steel paddle-wheel passenger steamer, built for the South Eastern Railway Company's service between Folkestone and Boulogne.

Messrs. R. & H. Green, of Blackwall Yard, E., occupy their space, No. 944, with a very well made model of a light ship.

Messrs. Yarrow & Co. exhibit, at No. 945, models of the stern-wheel steamers *Lotus* and *Water Lilly*, built for the Nile expedition, and the model of four sea-going torpedo-boats built for the Brazilian Government.

Messrs. Oswald, Mordaunt & Co. have a very good display, at No. 947, of models of steamers, and several special models illustrative of improvements introduced by them.

The most perfect model of marine engines, and we believe the only one in motion, is that exhibited by Messrs. Maudslay, Sons & Field, in Group IV. (No. 407). It is a model of the four-cylinder compound engines as made for vessels of the White Star Line, and the Cie. Genérale Transatlantique of France.

NOTES ON SHIPBUILDING.*

By Mr. J. H. Biles (of Messrs. J. & G. Thomson), Clydebank, Glasgow.

WHEN the secretary of this Institution asked me, "as one who is in the thick of the work," to contribute a paper on "Steel Shipbuilding," I could not but feel honoured. The year that this Institution holds its meeting in the home of steel shipbuilding is not one when no contribution should be made to the literature of this subject unless there is absolutely nothing new to talk about, and I therefore, though reluctantly, have prepared a paper which, I hope, will serve to elicit a valuable discussion, if it does not by itself impart any information.

There are two questions to be considered in undertaking to build any ship; the first is the constructive possibility, the second is the commercial desirability. The first has become a certainty, as is evidenced by the increasing percentage of the total ships built which are steel, and by the confidence which is now felt by the great majority who have had the necessary enterprise to build in steel.

The second has been several times demonstrated. First, by Mr. Martell, in 1878, who showed that a better profit could be made in a steel than in an iron ship; secondly, by Mr. William Denny, in 1881, before this Institution, who showed the price per ton of steel, in relation to iron, which must rule in order that, per ton of dead-weight carried, a steel ship should be as cheap as an iron one. Mr. William John, before this Institution last year, pointed out that the relation between steel and iron necessary to make a steel ship as cheap in first cost, per ton of dead-weight carried, had been reached. This was a great point for steel to reach, because it made a comparison of profits independent of the freights, which was not the case in Mr. Martell's comparison. I shall endeavour to show later on that we have reached, on the Clyde, a relative price of steel to iron, where for the same size of ship the cost is practically equal, and therefore the shipowner is in a position to have a considerable increase to his weight-carrying for the mere deciding whether his vessel shall be built of steel or iron. Why another iron cargo-carrying ship should be built upon the Clyde it is difficult to see; and I shall endeavour to show later on that even in ships where dead-weight carrying is not the desideratum, but where capacity is, by properly modifying the dimensions the full advantage gained by the dead-weight carrier can also be obtained by the measurement goods carrier.

With the change from iron to steel as a common material of ship construction, there must necessarily follow some changes, great or small, in the construction of the ship, and in the general design in so far as the weight and strength of the structure-forming material affects the question of weight-carrying, stability, and principal dimensions. The experience of the last ten years in the manufacture of steel, and its application, among many other purposes, to ship construction, had enabled its users to say with certainty that a steel ship can be constructed with at least as much certainty of success in all respects as an iron, provided that the dimensions are chosen, the structure is designed, and the work of building is carried out with a full appreciation of the fact that the ship is to be a steel one and not an iron one.

With the adoption of the 20 per cent. reduction allowed by Lloyd's, and as carried out in their latest volume of rules by the substitution of the same number of twentieths of an inch in thickness in a steel ship for the corresponding number of sixteenths in an iron ship, the reduction in the weight of material, after allowance has been made for the different specific gravities of the two metals, must be about 17 per cent. But there are

* *Paper read before the Iron and Steel Institute, at Glasgow.*

certain restrictions in this matter of reduction, such as thickness and arrangement of butt straps, which prevent the full 20 per cent. from being realized. From approximate estimates made, it appears that in the different classes of ships the amount of material saved per cent. is about as follows:—

Tons.	Per cent.
1,500	13.9
2,500	13.7
3,500	13.5
4,500	13.3

These figures are based upon actual ships, which are principally cargo carriers, but have a small amount of accommodation for passengers. It may be interesting to see why it is that though the scantlings or thicknesses are reduced by 20 per cent., the net gain in weight of structure is only about 14 per cent. of the changed material.

It is necessary here to state that after allowing the 20 per cent. reduction in thickness generally, Lloyd's ask for an increase in the thickness of certain butt-straps in the outer bottom plating, and in the stringers, and also for an increase in the number of the rivets in the butts. To those two modifications are due the fact that the full 17 per cent. reduction cannot be gained.

The following table shows for different sizes of ships the actual thickness and proportions of butt-straps to plates in iron and steel ships respectively:—

IRON.

Numeral.	Plate Thick.	Strap Thick.	Rivetting.	Per Cent. Weight.
below 8,000	$\frac{7}{16}$	$\frac{8}{16}$	Straps of sheer stringer and one bilge strake $\frac{1}{16}$ thicker, and double rivet for $\frac{1}{2}$ l.	6.6
24 to 28,000	.7 $\frac{11}{16}$ to $\frac{12}{16}$	.75 $\frac{12}{16}$ to $\frac{13}{16}$	Straps of sheer stringer and all outside strakes $\frac{1}{16}$ thicker, and treble rivet for $\frac{1}{2}$ l.	10.9
33,000 and above	$\frac{12}{16}$	.875 $\frac{14}{16}$	All straps of plating and U. and N. double stringers $\frac{2}{16}$ thicker, and treble rivet for $\frac{2}{3}$ l. Length of plates, 14 ft.	11.6

STEEL.

Numeral.	Plate Thick.	Strap Thick.	Rivetting.	Per Cent. Weight.
8,000	$\frac{7}{20}$	$\frac{8}{20}$	Straps of sheer stringer and one bilge strake $\frac{1}{20}$ thicker. Breadth of double rivet straps, 9¾ in.	6.6
24 to 28,000	.55 $\frac{11}{20}$ to $\frac{12}{20}$	.75 $\frac{15}{20}$ to $\frac{16}{20}$	All butt strap, treble rivet back row complete for $\frac{3}{4}$ l. Butt straps $\frac{4}{20}$ thicker for $\frac{1}{2}$ l. Remainder, $\frac{2}{20}$. Straps—double, 11¼ in.; treble, 16¾ in.	13.
33,000	$\frac{12}{20}$	.8 $\frac{16}{20}$	Whole of butts fore and aft, treble rivet back row complete, and straps, $\frac{4}{20}$ thicker. Straps—double, 11¼ in.; treble, 16¾ in. Length of plates, 14 ft.	13.3

From this it will be seen that there is in steel ships, with a numeral above 8,000, more butt straps required to the extent of from 2.7 to 1.7 per cent. of the weight of the plates than of iron. In the larger ships the butt straps are actually as thick in the steel as in the iron ship. This is rather unfavourable to the steel ship, for the extra thickness cannot be required for tensile strength any more in the steel than in the iron ship, and if it is necessary to support the butt to resist compression, it may as well be iron as steel. If these straps be iron instead of steel in a steel ship, a saving of about £100 in a 4,000-ton ship would be made.

The following table has been prepared to show in some detail the changes which take place in every 100 tons of an iron ship, when it is modified to a steel ship of same dimensions, classing at Lloyd's in the 100 A1 class:—

—	1,500-Ton Sailing Ship.			5,500-Ton Steamer.		
	Iron Plates Assumed 14 ft. by 44 in.	Steel Plates Assumed 14 ft. by 44 in.	Steel Plates Assumed 16 ft. by 60 in.	Iron Plates Assumed 14 ft. by 44 in.	Steel Plates Assumed 14 ft. by 44 in.	Steel Plates Assumed 16 ft. by 60 in.
Outer bottom plating and stringers	31.2	25.9	25.9	22.8	18.9	18.9
Butt straps to ditto ..	2.23	2.22	1.95	2 13	2.37	2.04
Rivets to ditto	.68	.78	.68	.68	1.00	.88
Laps to outer bottom plating, &c.	3.4	2.14	2.01	3.3	2.74	2.01
Rivets in ditto	2.23	2.16	1.57	2.23	2.16	1.57
Other iron which can be changed to steel.	47.0	39.6	3.90	44.9	36.7	37.3
Rivets to ditto	2.9	2.9	2.7	2.7	2.7	2.5
Other iron which is not changed to steel	9.76	9.76	9.76	20.10	20.1	20.1
Rivets to ditto	.6	.60	.6	1.36	1.26	1.26
	100.00	86.66	84.17	100.00	87.93	86.56

The results are given for two ships very widely different, a 1,500-ton sailing ship, and a 5,500-ton cargo passenger steamer. On the total weight of iron plates, angles, and rivets, there is a saving of 13½ per cent. in the sailing ship, and 12.07 per cent. in the streamer, on the assumption that the limits of length and breadth of the plates are the same. But it is at this point that steel has a great advantage over iron, and one which, in the construction of ships, will materially help it to completely displace iron as the staple structural metal. The effect of the advantage of using larger plates is that less weight for a given thickness is used in laps and butt straps; less rivetting is required; less scrap is produced; less time is required in construction, and less cost for labour is involved. In the two third columns of the above table are given the percentages of the different items, on the assumption that the limits of length and breadth are 16 ft. by 5 ft. The increased reduction due to this cause is 2.5 per cent. in the sailing ship, and 1.37 in the steamer, making the total reductions from iron 15.83 per cent. and 13.44 per cent. respectively. This is a point of the greatest importance in the future of ship construction; and it is to be noted that the objections pointed out by Mr. Parker, in his paper read at the meetings of the Institute of Naval Architects, in April last, to the use of large heavy plates in boilers, do not hold to the bulk of ship plates, as they are not subjected to furnace work.

From the foregoing table it may be easily deduced that if iron plates and angles cost 5*l.* per ton overhead, and rivets 8*l.* 10*s.*, that the material for a steel ship can be bought for the same money as an iron ship, if steel is 6*l.* per ton, if the limits of size are the same as iron, and 6*l.* 3*s.* 6*d.* if they are as indicated in the third columns, *i.e.*, with the increased size of plates.

But this calculation takes no account of any of the other advantages due to the use of large plates. If we allow for one only—the reduced number of rivets—the overhead price of steel per ton, which must be quoted, in order that the steel ship shall be built at least as cheaply as an iron one, is 6*l.* 9*s.* Of the prices quoted us during this year for steel and iron, the mean overhead rates are—for steel, 6*l.* 9*s.*; and for iron, 4*l.* 19*s.* 3*d.* Without dealing further with the question of difference in cost of labour, which is decidedly in favour of the steel ship, one is in a position to say that on the Clyde a ship built to class at Lloyd's, according to their published tables, can be built at least as cheaply in steel as in iron. This being so, the advantage to the steel ship is obvious, if weight-carrying power is of any commercial value to her.

As a steel ship can be built as cheaply as an iron one of the same dimensions, it follows that, per ton of deadweight carried, a steel ship must be cheaper. The 1500-ton sailing vessel referred to will, if built of iron, carry about 2260 tons, and if built of steel, 2400 tons, or 6¼ per cent. more cargo. In the 5500-ton steamer the gain is 10 per cent. if the vessel be assumed to have a twelve-knot sea speed, and to carry coals to take her from Liver-

pool to New York. If the voyage be longer the gain per cent. in cargo-carrying weight will be increased.

As these gains in cargo-carrying can be obtained without any extra first cost, and with a very small increase of working expenses (dock dues, coals, crew's wages, and provisions, insurance, &c., all remaining unaltered), it is difficult to see why any iron sailing or steam cargo-carrying ship should be built upon the Clyde, or any other river where steel works are as close at hand as iron works.

Experience has shown the reduced risk of total loss due to stranding in a steel ship, and now that Lloyd's have to a certain extent re-issued their "Rules for Steel Ships," it is fair to infer that they have no doubt that the 20 per cent. of the reduction of scantlings, makes a steel ship at least as strong as an iron ship. Two objections have usually been urged against steel ships. The first is that, as steel is so ductile, ships built of it are much less rigid than iron ones, and will soon begin to work.

At Clydebank we have built, or are building, twenty-eight steel ships, representing over 50,000 tons, and in no single instance that has come to our knowledge has any defect in the structure been due to material. As these 28 vessels include such great varieties as Transatlantic liners like the *Servia* and *America*, sailing ships, ordinary cargo steamers, and river steamers such as the *Columba* and *Grenadier*, the experience embraces all kinds of vessels, and it shows that ships can be constructed in steel, with a 20 per cent. reduction, as strong as iron ships. This experience is not uncommon with all shipbuilders who have built largely in steel.

The second objection is that steel more rapidly corrodes than iron. It is certain that if an iron ship be not watched and carefully coated, so as to prevent corrosion, she will very soon receive considerable injury. It is also certain that if properly coated and watched, an iron ship is practically indestructible. It seems, therefore, to be much more a question of relative care necessary to protect the material, then the relative amount of corrosion which will go on if no care is taken; and if a little extra care is required, it cannot be anything like a set-off against all the other advantages in a steel ship. The Admiralty, however, having discovered that the most of the corrosion which has come under their notice is due to the galvanic action which takes place between the black oxide or scale and the metal itself, they treat all their outer bottom plating, floors, and lower plates of bulkheads, in a dilute acid bath to remove the scale. In carrying out this operation for the *Scout* class, which are at present building for the British Admiralty, we have devised a fast-running wire-brushing machine, which, after the plate has been dipped in the acid bath, burnishes the surface of the plate, leaving it almost like silver. This operation does not cost more than 1s. per ton extra over the whole of the ship, and it might be advisable for steel manufacturers to do this at their own works from the under-water portion of the outer bottom plating. The plant necessary is comparatively inexpensive. Another method of meeting this objection to steel, is to galvanise those plates which are most liable to corrosion. The torpedo boats built by Messrs. Yarrow and Messrs. Thornycroft, which have outer bottom plating varying from $\frac{1}{16}$ in. to $\frac{3}{16}$ in., have a great portion of their structure galvanised. The floors and lower plates of bulkheads of *Scout* are galvanized. Messrs. Denny have galvanised the plates of some of the light-draught vessels for the Irrawady Company, and also have galvanised the tank-tops of some of their ships in the way of the boilers.

It may be desirable to galvanise all the outer bottom plating of ordinary ships, and it has been pointed out by Mr. Denny that unless something of this kind is done, it will not be possible to take full advantage of steel having higher tensile strength than that at present in use. This question of corrosion has a similar bearing in ships to that which it has in boilers, for it is certain that if the liability to corrosion is the same in both thick and thin plates, there must be a thickness beyond which it would not be advisable to reduce, however high a tensile strength the material may have. If galvanising can be successfully and generally applied, this minimum will be much reduced, and the increase in tensile strength can be much further extended. At present the extra cost is its chief drawback; but if higher tension steels be adopted, some of the saving in cost due to them must go to pay for galvanising.

I think it may be fairly claimed for a steel ship built to Lloyd's scantlings, as compared with an iron one of the same dimensions, that its first cost is not greater; its strength is greater, liability to loss from collision or stranding is less, its liability to damage by corrosion need not be greater, and its dead-weight carrying capability (which is the *raison d'être* of nine ships out of ten) is much greater. But a shipowner in a measurement goods trade may say, "I don't want a stronger, a safer, or a greater weight-carrying ship, even for the same money, because if I don't have the weight in the structure, I must put in ballast." This kind of objection may be applied to vessels like those of the Union and Donald Currie lines, which carry out general cargo to Cape Town and return with wool or nothing. To these shipowners it is necessary to point out that an increase in depth, accompanied by an increase in breadth, to preserve the stability, will add to the capacity, and therefore to the weight to be carried; and if the operation be carried far enough, they will in most trades come to a point where, even with a measurement cargo, it will be possible to overload a ship and to lead the shipowner to say, "I wish this ship's hull were not so heavy." In other words, by properly choosing the principal dimensions of a ship, it is possible to reduce all trades to dead-weight trades. I am quite aware that there are some considerations which come in to modify this statement, but they need not be further discussed here than to say that they may slightly reduce, but they cannot take away, the force of the above proposition.

To trades which are neither dead-weight nor capacity, such as high-speed passenger steamers, there is almost always a limitation of draught. The dead-weight carried by these vessels is almost always their machinery and coals, and consequently anything which tends to increase their weight-carrying may be made available for an increase of speed. Hence we are not likely to see high-speed passenger vessels built of iron again.

There does not, therefore, appear to me to be any reason, with prices as they are at present, why another iron ship should be built upon the Clyde or any other river where steel can be produced relatively as cheap as it is here.

The question of the reduced size of steel ships to carry the same dead-weight, and the consequent reduced first cost, I have not dealt with, as Mr. William Denny so ably handled that subject in 1881. But if in the 1500-ton sailing ship and in the 5500-ton steamer, there is a gain of $6\frac{1}{2}$ per cent. and 10 per cent. respectively, as before stated, it is obvious that there must be practically $6\frac{1}{2}$ per cent. reduction of first cost in the sailing ship and 10 per cent. in the hull of the steamer, in order that they should carry the same dead-weight. From the latter stands to be deducted from the first cost the saving in the cost of the engines of the smaller ship, and also as a recurring reduction the decreased pock dues and coal consumption.

(To be concluded in our next.)

HER MAJESTY'S SHIP HERO.

On October 27th, at Chatham, a further and very formidable addition was made to the effective strength of the armour-clad fleet in the shape of the *Hero*, the new steel-built, armour-plated, turreted ram. At 2 o'clock in the afternoon this powerful vessel was floated out of dock in presence of a distinguished company, including Prince Leiningen, Commander-in-Chief at the Nore, and Princess Leiningen; Admiral Brandreth, Comptroller of the Navy; Admiral Watson, Admiral Superintendent at the Dockyard, and Mrs. Watson; General Hon. R. Monck, Commanding the Chatham District; Mr. Warren, Chief Constructor in the yard; and Mr. Deadman, Assistant Constructor. A large number of the public were accommodated in booths erected round the dock in which the vessel lay. As the tide rose the stays were removed from the ship's side, and by 2 o'clock everything was in readiness to float the vessel out into the river. The Prince and Princess Leiningen, with the other visitors, arrived punctually to time, and the Princess was presented on her arrival with a beautiful bouquet of white flowers by Miss Daisy Watson, daughter of the Admiral Superintendent. After a short service of prayer had been read by the Rev. Mr. Bearden, the chaplain of the dockyard, as is customary at the launching of ships in the Royal Navy, the signal was given, and the Princess having by means of a small lever broken a bottle of wine over the bows, and so christened the vessel, the huge mass began slowly to move out of the dock. As she began to move, "Three cheers for the *Hero*" were asked for by the Admiral Superintendent, and heartily given by the assembled multitude of sailors and dockyard hands. The *Hero* was hauled out of the dock by steam tugs from Sheerness and Chatham, by means of stout hawsers made fast on her deck and passed through the cable holes on either side of the bows of the vessel.

As she left the dock the band of the Royal Marines, which had been performing previously to the ceremony, played "Rule Britannia," and "God save the Queen." The *Hero* will now be taken into the basin at the extension works, and there completed for sea with despatch. The keel plates of this vessel were laid down as recently as the 21st of April, 1884, and therefore her building has not occupied more than about 18 months, a much less time than it has taken to build any of Her Majesty's ships now afloat. Mr. Salmon, foreman of the dockyard, superintended the building operations from start to finish. The *Hero*, as has been mentioned above, is an armour-clad, single-turreted ram. Her length between perpendiculars is 270 ft., while the extreme breadth is 58 ft. She is of 6,200 tons displacement, and when fully equiped will draw 22 ft. of water forward and 24 ft. aft. The sides of the hull are faced with steel armour of a *maximum* thickness of 12 in., while the sides of the turret and conning tower are faced with plates of the same material of a *maximum* thickness of 14 in. and 12 in. respectively. The upper and lower decks are protected by steel protective plating to a thickness on the upper deck of 1¾ in. and on the lower deck of 2½ in., and the platform in the after part of the ship is covered in the same manner to a thickness of 2½ in.

The armament of the *Hero* consists of two 12 in. breech-loading 43-ton guns in the turret, four 6 in. 89 cwt. breech-loading guns on the sponsons, seven 6-pounder quick-firing guns, one 9-pounder boat gun, two 7-pounder boat guns, one 9-pounder field gun, as well as seven 1 in. four-barrel Nordenfelt guns, and two ·45 in. five-barrel Gardner guns. She will also carry Whitehead torpedoes.

The engines, which are designed to propel the ship at a speed of 15½ knots per hour, and have been built by Messrs. J. & G. Rennie, of London, are twin-screw engines of the vertical inverted compound direct-acting type, of 4,500 I.H.P. with a natural draught, and 6,000 I.H.P. with a forced draught. They are of the same power and capacity as those of the *Conqueror*, the sister ship to the *Hero*, but embody many improvements upon the latter, having been adapted since that vessel was put in hand. Each screw has two cylinders of 42 deg. and 84 deg. respectively, with a stroke of piston of 3 ft., and adapted to a pressure of steam in the boilers of 90 lb. to the square inch. The framing of the engines is all of wrought iron, each cylinder resting on four columns of the lightest description consistent with strength, and all the shafts and other moving parts are of steel. The condensers are of brass, with brass tubes, having a cooling surface of no less than 9,500 ft. The circulating pumps are in duplicate for each engine room, so as to provide ample pumping power for discharging water from the ship in the event of a leak. In addition to all the above, there are in the engine department two main feed engines, four auxiliary feed engines, four auxiliary bilge engines, two steam fire engines, and two pumps.

The boilers have been constructed with special regard to strength and lightness, the whole of the material being flanged and riveted together by hydraulic machinery. They are in eight parts, and of the class known as oval return-tube boilers. The total heating surface of the boilers amounts to 14,400 square feet, and in addition to the ordinary natural draught arrangements have been made to supply a forced draught in the boiler-room by means of four fans driven by separate engines.

These engines were ordered in the spring of 1884, and have therefore been completed and got ready to go on board within a period of 18 months. They are the latest development of the compound engines, which have been made by Messrs. Rennie since the year 1870, when the type was first tried on board the *Briton*, the first case in which compound engines with two cylinders were made use of in the British Navy. They have since been applied to the *Bacchante* and the *Canada*, both of which vessels were selected by the Admiralty for the use of the Royal Princes during their cruise.

After the ceremony the visitors were entertained at luncheon by the Admiral Superintendent at his official residence in the dockyard.

Brunswick Patent Condenser.—Messrs. Jos. Price & Co. have been awarded the silver medal at the Inventions Exhibition for their "Brunswick" Patent Condenser, Refrigerator, or Heater, for distilling fresh water on board ships, or for heating feed water for boilers, &c., &c., which has been favourably received by engineers and the press as a thoroughly efficient, practical, and economical apparatus for the above-named purposes, being easily taken to pieces for cleaning.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—With the exception of the establishments where orders for Government work have been placed, winter prospects for the Tyne shipbuilding trades are exceedingly gloomy. At the Elswick yard of Messrs. Armstrong, Mitchell, & Co., the construction of the ironclad and the two gunboats ordered by the Admiralty is making satisfactory progress—so satisfactory, indeed, that with reference to the former, the statement is being made that there are now about 150 tons more material worked up in it than has so far been used in the building of the sister ship on the stocks of the Thames Ironworks Company, Limited, both vessels having been commenced at the same time. Messrs. Palmer, Jarrow, are getting well on with the two Government vessels they have in hand, and from a statement recently made by the head of the firm, it may be inferred that they are tolerably well supplied with orders for other descriptions of work. At all events full confidence is felt throughout the district that the Jarrow yard will be kept busy over the winter months. The firm have ordered the steel stern frames and rudders required for the two cruisers from Messrs. Spencer, of the Newburn Steel Works, and they are also getting the last-named firm to manufacture for them a large part of the plant and appliances required for the new steel works, which they are erecting themselves. Messrs. Armstrong, Mitchell & Co.'s Low Walker yard is in the last stage of slackness, there being but one vessel on the stocks to which any considerable amount of work is to be done. The firm lately tendered for a large vessel, which they intended to lay down in the Low Walker establishment, but they were beaten by a Hamburg firm of shipbuilders, who tendered lower than them to the extent of £2,000, and secured the contract. It is stated that the cost of labour at Hamburg and other continental centres is fully 50 per cent. less than in this country, and in that significant fact will probably be found the reason why the eminent English firm was forced on this occasion to give place to the foreigner. With reference to the other yards on the Tyne there is nothing new to state, all of them being slack or closed, with the exception of the extensive establishment at Hebburn, which is still well provided with work, but in which a falling off is beginning to be perceptible. The last vessel launched has not been succeeded by another on the stocks, and frame turning has been discontinued for some time. Through the action of the Boilermakers' Society, shipbuilders are now likely to be confronted with another difficulty in carrying on their work. That body, which hitherto has dictated its own terms to employers in this district, has recently issued a mandate that piece workers must restrict themselves to earning no more than "time and half," and that on repair jobs no piece work at all will be allowed. Practical men will understand how such regulations, if carried out, will increase the cost of production by causing the execution of the work to be spread over a longer period, and shipbuilders, who are already sufficiently hampered by restrictions of various kinds, should assert their prerogative and refuse to tolerate such unjustifiable interference with their methods of carrying on work. In the marine engine trade, Messrs. Palmer's works, Jarrow, and Messrs. R. and W. Hawthorn's, St. Peters, are the only establishments that are showing anything approaching to a satisfactory state of business. Messrs. R. Stephenson & Co. have some work in this line, but they are getting on very slowly with it, being evidently not pressed for early delivery. At the Victoria Engine Works, Gateshead, where the specialty of manufacture is steam winches for steam and sailing ships, the trade depression has had the effect of reducing the production to one-fourth the ordinary output. The firm are now about to add to their business the manufacture of apparatus for a new system of electric lighting, and a new building has been erected for the purpose within a short distance of the present premises. Messrs. Carrick & Wardale, of the Redheugh Engine Works, are doing pretty well, their specialties being much in favour with steamship owners. The chainmaking industry in this locality is in a state of almost total collapse, there being no work to speak of at either Messrs. Abbots' or Messrs. Hawks's establishments. Forges and foundries are still, with few exceptions, slack, and the state of business in the rolling mills is no better than it was a month ago.

Wear.—The trade depression on the Wear—especially so far as the staple industry of shipbuilding is concerned—has now reached a critical point, and distress is becoming very apparent among the operatives and labourers. A deputation from the unemployed men waited on the Board of Guardians, asking them to adopt special measures of relief on their behalf, and it is now understood that some action in this direction will be undertaken at once.

One favourable circumstance is to be reported in connection with the shipbuilding trade, and it is that Messrs. Bertram & Haswell, a firm who have had their machinery standing for over eighteen months, have obtained an order for a good-sized steamer, and will shortly re-open their yard for work. Mr. Laing has commenced the construction of a vessel, the order for which was given a couple of years ago, but was shortly afterwards cancelled. The frames were bent at the time, but nothing further was done, and it is now understood that the construction of the vessel is undertaken mainly with the view of providing present employment for the workmen. Messrs. R. Thompson & Sons, having launched a small steamer which was built in an unprecedentedly short space of time, have temporarily closed their Southwark yard, and suspended even the apprentices employed there. The foreman, clerks, and other permanent officials, are, however, still retained. The firm are keeping their yard at the Bridge Dock open, and have an extensive repairing contract in hand there at present. Messrs. Short Brothers have commenced rivetting the frames of a large steamer ordered by a local shipowner. The advantage of Tweddell's hydraulic riveters, which are in use at Messrs. Shorts' establishment, may be judged from the fact that the price paid for rivetting these frames is no more than half the current figure paid for handwork. Messrs. J. L. Thompson, of the North Sands yard, are constructing a plate furnace of an improved type, and are also making arrangements for lighting their establishment on a more economical principle than that generally employed. The yard is still busy, and is the only one on the Wear which can be so described. In reference to other establishments there is nothing new to state, most of them being either closed or doing very little. In the marine engine trade, the only fresh matter to note is that Messrs. Dickinson have obtained orders for three engines, intended for boats now building in the district. This accession of work came at a most opportune time, as the firm had nothing in hand, and it will keep the works pretty steadily employed over the winter months. The state of work in the foundries, forges, rolling mills, and chain works is still extremely bad, and the operatives connected with them are largely swelling the idle crowd.

Hartlepool and the Tees.—Mr. Gray's yard, West Hartlepool, is still pretty busy, but other shipbuilding establishments in that locality are almost entirely without work. Messrs. Richardson's marine engine works continue to be fairly well employed. At Middlesbro', Messrs. R. Dixon & Co, and at Stockton, Messrs. Richardson, Duck & Co., are having a good show of work in their yards, but at other establishments the state of business could scarcely be worse than it is. An effort is being made for the establishment of a sliding scale to regulate blast furnacemen's wages in Cleveland. There is a difference of opinion, however, between the employers and the men, as to the basis which should be adopted, and this point is likely to be submitted to arbitration.

On September 1st the Lindholmen Engineering Works, Gothenburg, launched the *Sviet* steamer, a vessel of some novelty, as being the first steamer built for the carrying of petroleum in tanks in the hold from Batoum and Odessa to Mediterranean ports. Her dimensions are: Length between perpendiculars 289 ft., breadth 36 ft., and depth in the hold 24¾ ft. Her capacity is 1,700 tons dead-weight, and the engines will give her a speed of 10 knots per hour when loaded. The *Sviet*—Light—which is built throughout of soft Motala Bessemer steel, has been constructed for the Russian Steam Navigation and Trading Company, of Odessa, an association which intends to compete with the American oils in the European markets by the saving of transports on their own in the manner indicated. By the establishment of this new route, the link wanting for the completion of the Russian oil trade to Europe from the Caspian Sea will have been added. The company has ordered three similar vessels in Sweden.

The total amount of the subsidies granted by the Russian Government to the various state-aided shipping companies for the ensuing year has been fixed at £153,553.

At a meeting of the Boston Town Council on 24th September, it was resolved to purchase two dredgers from Messrs. Fleming and Ferguson, of Paisley, for the sum of £37,400, and also to purchase twin propellors for the sum of £450 for each dredger. The dredgers are to be used in connection with the Ribble improvement works.

Durham's Oil Ring Company have removed from New Barnet to more central offices, 27, Leadenhall-street, E.C., necessitated by the rapid increase in their business.

This month the first section of the Panama Canal will be opened to its full breadth and depth. It will comprise a waterway from Colon to Tiger Hill a distance of 12 kilometres.

Reviews.

The Works' Manager's Handbook. By W. S. Hutton. London: Crosby Lockwood & Co. Second Edition.

A work such as this, which ran through its first edition in an almost unprecedentedly short space of time, must have some inherent good qualities to commend it to the engineering fraternity, otherwise a second edition would not have been so rapidly called for.

The mere mention of the headings of the six sections into which the work is divided, will show at once how farspread and varied is the information covered in its pages, and it is doubtless owing to the wide range of subjects that the author has embraced, and the large amount of varied and useful information given under each of the different headings, that the great popularity and rapid sale of the work is to be attributed.

The six sections deal copiously with the following subjects:—Section I. Stationary and Locomotive Steam Engines, Gas Engines. II. Hydraulic Memoranda: Pipes, Pumps, Water-power. III. Millwork: Shafting, Gearing, Pulleys. IV. Steam Boilers, Safety Valves, Factory Chimneys. V. Heat, Warming, and Ventilating; Melting, Cutting, and Finishing Metals; Alloys and Castings; Screw Cutting. VI. Strength and Weight of Materials; Workshop Data, &c.

In compiling the second edition, the author has availed himself of the opportunity to carefully revise and correct the work, and some of the tables given in the previous edition have been reconstructed.

Perhaps the most valuable testimony that we can give as to the general utility of the book is furnished by one to whom we lent the volume, with the request that he would be good enough to make constant reference to it in his miscellaneous engineering practice.

After many hundreds of references, extending over four months' constant use of the book, he informs us that he has never once turned to the book without finding the information he was in quest of. The work is well got up, copiously and carefully indexed, and is singularly free from printers' errors.

Reed's Engineers' Handbook. By W. T. Thorn. Sunderland: Thomas Reed & Co.

We have now before us the eleventh edition (revised and considerably enlarged) of this most admirable handbook, and, after a careful perusal, we can only give it an unqualified measure of praise.

Perhaps the best recommendation that can be given to such a work as this is the mere statement of the fact, that it has already run through no less than ten editions, and that the present edition is a great improvement upon the previous ones.

We heartily commend the work to all engineers going up for their examinations before the Local Marine Board for certificates of competency either as first or second class engineers, and we are of opinion that those engineers who wish to ensure a successful termination to their examinations, will be acting decidedly against their own best interests if they do not carefully go through this work previous to their going before the Examining Board, for it is, as the title suggests, in every respect a most complete and comprehensive "handbook" to these examinations.

The work should be in the hands of every marine engineer, for, in addition to its great value as a "coach" to those preparing for examination, it contains a large fund of most useful information, which cannot fail to render it acceptable to the oldest engineer as a book of reference.

The most conspicuous and certainly the most important improvement that we notice in the present edition, is the large increase in the number of illustrations of parts of the machinery and other objects referred to in the text, these illustrations reaching the large total of 260 in the present edition, and these, together with 36 large plates of parts of engines, indicator diagrams, &c., comprise, it is believed, an example of every subject that has ever been given at the drawing part of the examination; and after carefully going over this excellent series of illustrations, we cannot detect the omission from it of any material part of a marine engine.

All new questions, and the latest requirements for the Board of Trade examinations have been added, and we quite endorse the proprietor's hope that this edition will continue to maintain and even greatly increase the value and popularity of the work. As showing the spirit in which the author writes, and the deep interest he

takes in all that redounds to the credit of the service, we give the following short quotation from the work, and we would most earnestly commend this to the careful consideration of our readers:—

"The only safe guide for passing in future examinations will be to be thoroughly conversant with the principles of the steam-engine. A candidate for a certificate of competency should give some evidence that he has applied his mind to his calling with as much earnestness as is expected in the case of an applicant for a medical diploma. The certificate he gets does not describe him as a driver only—as a man who can be safely trusted to start or stop an engine, or to regulate the feed on a set of boilers—his certificate refers to the possession of that degree of *engineering* kowledge which alone can justify his holding a certificate as an *engineer*. He ought, therefore, to be able to explain the why and wherefore of everthing about the action of the steam-engine, the combustion of fuel, and the strength of the materials used in the construction of engines and boilers."

Finally, we can only say that the book is well printed, and strongly and serviceably bound; and that the clear and finished manner in which the numerous illustrations are produced show them to be the work of an accomplished draughtsman.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

THE POSITION OF MARINE ENGINEERS.

To the Editor of The Marine Engineer.

Sir,—In my last letter I endeavoured to point out some ways in which our position as marine engineers was injured, and how, in those respects, it was in our own power to improve it. I regret to find that (probably from my want of experience in writing for the Press) I have not expressed myself in such a way as would enable "A Marine Engineer," whose letter appears in your October issue, to understand my meaning. With your kind permission, I would like to point out in what way he has mistaken it.

1st. He states that I "belittle the question of men who are not engine-fitters being appointed engineers"; as I clearly described the appointment of firemen and pattern-makers as "very objectionable." I have no doubt most of your readers would see that I thought that none but practical engine-fitters should be permitted to go to sea as engineers.

2nd. "A Marine Engineer" seems to be under the impression that I desire that men, on joining a ship, "should not give a true report of the state of the machinery," but give "a lying report." Now, what is suggested in my letter is that a habit, which is unfortunately very common, of using exaggerated language in speaking of any trifling defects that may be found on joining a ship should be amended. I mentioned that, as a rule, this sort of language was used without much cause, and I think it clear that not until the use of it is abandoned, will "true reports" be given.

3rd. My suggestion that we should try and improve our position by "care as to the character of the assistants we engage, and by only recommending those for employment who are worthy of it," which would of course make it difficult for the dissipated few to get to sea, is met by the strange assertion that those men "only serve to make more prominent the men who conduct themselves properly. I am surprised that "A Marine Engineer" should be unable to see that they also serve to bring a great deal of discredit on the class they disgrace, to lower our social position, and to furnish our enemies with instances, that they are only too ready to quote against us. I am aware that a large and useful class like ours ought not to be placed at a disadvantage on account of the misconduct of a small minority, but that we are is undeniable; we should therefore, as practical men, endeavour to weed our ranks of those who are unworthy to be in them. The proposal of "A Marine Engineer," that we should memorialise the Board of Trade to alter the qualifications required for a certificate of competency, and to lower the power above which a chief engineer must have a certificate, is a good one, but he makes a mistake in stating that the Board of Trade consists of "practical men who have an intimate knowledge of a marine engineer's position," when, as is well-known, it consists of a few government officials who have no practical experience of sea-going life, and whose principal advisers are Captain Sir George Nares, R.N., and Sir Digby Murray, formerly a captain in the merchant service. It would be well therefore not to be too sanguine as to the reception any memorial we might send would receive, and while, like most engineers, I would be glad to sign one, we must not allow the hope of its being successful to divert our attention from other means of effecting the desired reforms. Before conclu ding, I would like to express a hope that now the different griev ances we labour under have been so clearly pointed out by several of your correspondents, that future letters should be directed more to the discussion of the causes that have produced these grievances, and the best means of remedying them. Hoping that you will allow this important part of the subject to be discussed in your valuable journal,

I am, Sir, yours obediently,

AN OLD CHIEF.

Newcastle, *Oct.* 11, 1885.

Sir,—I noticed a letter in your May issue signed "T. C.," and there is one paragraph with which I heartily agree, and one which deserves the serious attention of marine engineers, and in fact all sea-going people, *viz.*, that certificates of competency should not be issued to foreigners unless they be naturalized British subjects. The Americans recently passed an Act of Congress by which nc foreigner can be an officer or engineer of an American ship. The Germans have a similar act. A Britisher can't get employment in a Spanish ship, if a Spaniard can be found. In fact, in the mercantile marine of any continental nation, employment is forbidden provided they can get one of their own countrymen. But what is England doing? Our own seamen are deteriorating, and the good berths are getting filled by Germans, &c. In fact some of the steamers chartered by the Government for armed cruisers were officered by foreigners. This is a pretty good lookout in the case of war. At the present moment, Sept. 2nd, there is a small British steamer named the *Mary Austin* on this coast, in which there is not a single British subject employed, although there are plenty of sober, steady Britishers, both engineers and officers, unemployed ashore. Too much pity is taken on the foreigner while our own people can walk about and starve. The German Consuls use every influence with owners and superintendents to find berths for their countrymen in British ships, and every six months send them a form in which they have to state the expenses of the ship, the trade engaged in, the class of goods carried, the way in which they are packed, and the estimated profits. These are carefully tabulated and forwarded home, so that German shipowners know more about our mercantile marine than ourselves. It is to be hoped now the attention of engineers is called to it, that engineers' institutes will take the matter in hand, and place it through some M.P. before the Privy Council, so that a stop shall be put to this wholesale granting of certificates to foreigners, and end a grievance which has been allowed to continue too long, and which has injured the best interests of our commercial marine.

Yours, &c.,

Temperance Hall, Hong Kong, J. E. W.
September 2, 1885.

Besides the *Nile* line-of-battle ship to be laid down at Pembroke, the Admiralty has decided to construct another ship, to be called the *Trafalgar*, of the same dimensions as the *Nile*, and equal to the largest first-class ironclad of the British Navy afloat. She will be laid down whenever the drawings are completed at Portsmouth. The new vessels will be planned upon Sir E. J. Reed's model. They will differ from the *Admiral* class now being built, in that their citadels will be longer and higher, so as to secure more initial stability and greater range. The citadels will be constructed of 18 in. armour, and the waists of the ships are to be belted with steel armour-plating of the most approved type.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—ED. M. E.]

LAUNCHES.—ENGLISH.

Mereddio.—On September 26th Messrs. Wm. Gray & Co. launched an iron screw steamer built to Lloyd's highest class, for Messrs. Marshall, Dobson & Co., of Leith. The dimensions of the vessel are 254 ft. by 35 ft. by 18 ft. moulded, and she will carry about 1,900 tons deadweight. A poop is fitted aft containing a handsome saloon and state rooms; a raised quarter-deck is carried forward and joins the bridge, and the latter is continued to the main hatch, and takes the chart and wheel house, which contains patent steam steering gear by Muir & Caldwell. The topgallant forecastle is fitted up for the crew, and on top, Napier Bros.' patent steam windlass is fitted. A double bottom is fitted throughout on an improved cellular principle, which, with the large peak tanks, provide an ample water ballast capacity. There are four large hatchways with strong and improved steam winches fitted to each. Two masts, schooner rigged, with topgallant yard fitted, and all through the equipment is of the most approved description for working both ship and cargo. A fine set of triple expansion engines of 140 N.H.P., are being supplied by Messrs. Blair & Co., Limited, Stockton-on-Tees. Mr. D. Huskie has superintended, during construction, on behalf of the owners. The vessel was gracefully christened by Mrs. Farmer, wife of the Rev. J. Farmer, of Nottingham, and named *Mereddio*.

Chelyara.—On September 26th Messrs. Joseph L. Thompson and Sons launched from their shipbuilding yard, North Sands, Sunderland, a steel screw steamer named the *Chelyara*, built to the order of Messrs. Angier Brothers, London. The vessel is of the following dimensions, viz.: Length, 312 ft.; breadth, 40 ft.; depth of hold, 25 ft. The engines are being supplied by Messrs. Thomas Richardson & Sons, of Hartlepool, and are of the triple expansion type of 250 N.H.P. The same firm launched a steel steam yacht on September 25th, named the *Gadfly*, and have now in progress over 10,000 tons of steel shipping.

Stormcock.—On September 28th Messrs. Laird Bros. launched from their works at Birkenhead a powerful twin screw tug, built to the order of the Liverpool Screw Towing and Lighterage Company, and which was christened *Stormcock* by Mrs. Hill, wife of Mr. W. Becket Hill. The new tug is the third vessel of the name built for the same owners, her two predecessors having become the property of H. M. Government. She is of similar dimensions and power to the original *Stormcock* built by Messrs. Laird in 1878, the pioneer of the large twin screw tugs. The new *Stormcock* has a topgallant forecastle, midship house extended out to the gunwale, and other improvements in hull and machinery which experience has suggested.

Amana.—On October 8th Messrs. M. Pearse & Co. launched from their iron shipbuilding yards at Stockton-on-Tees, an iron screw steamer of the following dimensions:—Length between perpendiculars, 325 feet; breadth, extreme, 40 feet; depth of hold to top of floors, 27 feet 6 inches. She will be classed 100 A1 at Lloyd's, has poop, bridge-house, and T. G. F., double bottom for water ballast, and two iron decks. Her engines are on the triple expansion principle, by Messrs. Blair & Co. (Limited). As she left the ways she was christened *Amana*, by Miss Hingston, of Jersey.

Stella.—On Tuesday, October 13th, Messrs. Edward Withy and Co., Hartlepool, launched from their yard a steel screw-steamer, named *Stella*, built to the order of Messrs. Herskind & Woods, West Hartlepool. Her principal dimensions are:—312 ft. by 38 ft. by 21ft., with a deadweight carrying capacity of about 3,500 tons. The vessel has a long raised quarter-deck and bridge-house, short poop, and topgallant forecastle, and is fitted with double bottom for water ballast, all fore and aft, on Withy's improved longitudinal cellular principle (this is the 29th vessel built by Messrs. E. Withy & Co. on this principle). She has five steel watertight bulkheads, and the main, quarter, and bridge-decks, bulwarks, rails, and skylights are also of steel. The steamer is fitted with a large donkey-boiler, by Riley Bros., four steam winches, by Clarke, Chapman & Co.; Pepper's patent steam steering gear amidships; and Hastie's right and left screw gear aft; Emerson, Walker & Thompson Bros.' patent steam windlass, and Wasteneys Smith's stockless anchors, hauling into hause pipes. The saloon for the accommodation of the passengers, captain and officers, is finished in polished hardwood of a neat design. The vessel has been built under Lloyd's special survey for the 100 A1 class, and under the personal superintendence of Mr. Fothergill and Captain Petersen, superintendents for the owners. She will be fitted with triple expansion engines, 22 in. by 37 in. by 60 in. by 39 in. stroke; 1,000 I.H.P., and two single-ended boilers, by Messrs. T. Richardson & Sons, Hartlepool, fitted into Fox's patent corrugated steel tubes.

LAUNCHES—SCOTCH.

Saltees.—On September 22nd Messrs. D. & W. Henderson and Co., Meadowside, Glasgow, launched the *Saltees*, a steel screw steamer of 700 tons gross, and measuring 185 ft. by 27½ ft. by 14 ft. She has been built to the order of the Clyde Shipping Company, and had accommodation for 30 cabin and about 150 steerage passengers. The builders are fitting her with compound engines of 150 H.P.N., and having cylinders of 25 in. and 50 in. in diameter respectively, with a piston stroke of 36 in. This is the second steamer built this year for the same owners by Messrs. Henderson & Co.

Lismore.—On September 22nd Messrs. Charles Connell & Co. launched, from their shipbuilding yard at Scotstoun, an iron sailing ship of 1,650 tons, for Messrs. James Gardiner & Co., shipowners, Glasgow. She has been built to class 100 A1 in Lloyd's Register, and is fitted with all the most recent improvements. As she left the ways she was named *Lismore* by Miss Gardiner, and was immediately towed to the harbour, where Messrs. Aitken, Lilburn & Co. load her for Melbourne.

Thetis.—On September 24th there was launched at Dundee, by Messrs. Alexander Stephen & Sons, an iron barque named the *Thetis*. She is 1,374 tons register (gross), 243 ft. in length, 35 ft. 2 in. in breadth, and 23 ft. depth of hold. She has been built for the Messrs. Stephens themselves, and is intended for the Colonial trade. Captain Jarvis, late of their ship *Earl of Dalhousie*, will command her.

Hangchow.—On September 24th Messrs. Scott & Co. launched from their shipbuilding yard at Cartsdyke, a steel screw steamer of the following dimensions:—Length, 270 ft.; breadth, 33 ft.; and depth, 24.6 ft. She is of 1,600 tons burthen. As she left the ways she was named the *Hangchow*. The new vessel was towed into the Victoria Harbour, where she will be engined by the builders, the diameter of the cylinders being 25 and 58 in. respectively, with 3 ft. 6 in. stroke, the working pressure being 80 lb. to the square inch. The *Hangchow* has been built to the order of Messrs. J. Swire & Sons, London, for their Eastern trade.

Earlscourt.—On September 24th Messrs. Russell & Co., shipbuilders, Port Glasgow, launched from their shipbuilding yard an iron barque of 1,120 tons nett register. The vessel, which has been built to the order of Messrs. Keet & Kitt, shipowners, Liverpool, is of the following dimensions:—Length, 215 ft. 3 in.; breadth, 35 ft.; and depth of hold, 21 ft. She has been built under the personal supervision of Captain Pritchard. After the launch she was taken in tow to the harbour, where after having the masts put in she will load for Rangoon.

Crown of Italy.—On September 24th Messrs. Ramage and Ferguson, Leith, launched a large iron full-rigged ship, named the *Crown of Italy*, built to the order of Messrs. Robertson, Cruickshank & Co., Liverpool. The dimensions are:—Length, 242 ft.; breadth, 38 ft.; depth, 22 ft.; nett tonnage, 1,650. After being fitted out the vessel will proceed to Frederickstadt, where she will load a cargo of wood for Melbourne.

Quebracho.—On September 25th there was launched from the building yard of Messrs. John Fullerton & Co., Merksworth, Paisley, a steel screw steamer of about 200 tons, which has been built, much in excess of Lloyd's 100 A1 class, to the order of Messrs. Lees, Anderson & Co., engineers, Clyde Street, Glasgow, and is intended to ply on the River Plate. She is entirely built of steel, has teak decks and fittings, also steam windlass by Messrs. Thomas Reid & Sons, Paisley. The steamer was named the

Quebracho by Miss Helen P. Webster, Glasgow. The *Quebracho* leaves for Glasgow, where the engines will be put on board by Messrs. Lees, Anderson & Co., Clyde Street Engine Works.

Forfarshire.—On September 25th there was launched from the yard of Messrs. Birrell, Stenhouse & Co., Dumbarton, to the order of Messrs. Thomas Law & Co., of the Shire Line, Glasgow, an iron sailing barque, of 1,385 tons register. She has been built to the highest class at Lloyds, and designed to carry a large cargo, sail very fast, and stand without ballast. Captain Dawson, the owner's superintendent, has inspected her construction all throughout. As the vessel was leaving the ways she was named *Forfarshire* by Miss M'Lelland, of Glasgow. When completed she loads at Glasgow for Rangoon, and is expected to make a quick passage.

Steel Screw Steam Lighter.—On September 28th Messrs. J. M'Arthur & Co., Paisley, launched a steel screw steam lighter of about 100 tons, the engines of which are being supplied by Messrs. Bow, M'Lachlan & Co., of the same town.

Twin-screw Hopper Dredger.—On September 29th there was launched from the yard of Messrs. William Simons & Co., Renfrew, a twin-screw hopper dredger, of 400 tons. She is the property of the Royal Danish Government. She is to work at the new harbour works of Frederikshavn, and is the second hopper dredger the builders have constructed for Denmark. The vessel is fitted with William Simons & Co.'s patent traversing gear, which enables the vessel to cut its own flotation through shoals and banks. The engines are compound surface condensing, of 350 I.H.P., and the boiler is of steel, constructed for a working pressure of 80 lb. to the square in. The bucket ladder dredges to a depth of 30 ft. and fills its own hopper, which is capable of containing 300 tons. A workshop is fitted up with turning lathes, drilling machines, &c., to enable repairs to be done on board.

Natuna.—On September 30th Messrs. Russell & Co. launched from their Greenock shipbuilding yard the *Natuna*, a beautifully modelled iron sailing ship, of 1,120 tons register. She was built to the order of Messrs. Peter Denniston & Co., Glasgow, and measures 217 ft. by 35 ft. by 21 ft. 3 in. After being launched the new vessel was taken to Port Glasgow to be fitted out for sea.

Lamberton.—On October 3rd there was launched from the Caledon Shipyard, Dundee, Mr. W. B. Thompson, an iron steam trawler, named the *Lamberton*, the owners being a Berwick-on-Tweed company. The vessel measures 95 ft. by 19 ft. by 10 ft. 3 in., and is being fitted by the builder with compound surface condensing engines of 45 H.P. She will also be fitted with the most approved trawling appliances and with towing gear.

Evelyn.—On October 6th Messrs. J. M'Kenzie & Co., boat-builders, Leith, launched from their yard a wooden steam fishing vessel, named the *Evelyn*, built to the order of Messrs. Haworth & Clarke, Leith, and intended for the deep-sea net and line fishing. The dimensions are:—Length, 67 ft.; breadth, 17 ft.; depth, 8 ft. 6 in. The vessel will be supplied with engines by Messrs. John Cran & Co., Leith.

Armida.—On October 7th Messrs. Barclay, Curle & Co., Whiteinch, Glasgow, launched the *Armida*, a very fine steel sailing vessel of about 1,600 tons register, and measuring 252 ft. by 38 ft. by 33 ft. The *Armida* has been built for Mr. William Letham, Greenock, and is to be engaged in general trade.

Le Lillois.—On October 8th Messrs. Hawthorns & Co., engineers and shipbuilders, launched from their yard at Leith an iron steam trawler, 93 ft. in length, 20 ft. in breadth, and 11 ft. in depth. The vessel as it left the ways was named the *Le Lillois*, and has been built to the order of Mr. J. L. Dossaer, Ostend, Belgium. The vessel will be supplied by the builders with engines 35 N.H.P., and all the latest improvements.

Dordogne.—On October 12th Messrs. Osborne, Graham and Co. launched from their yard, at Hylton, a steel screw steamer named *The Dordogne*, to the order of Messrs. Hooper, Campbell and Co., Managers of the Cardiff Steamship Company. Her dimensions are:—Length, 200 ft.; breadth, 29 ft.: depth, 15 ft. Th e*Dordogne* will be employed trading between Cardiff and Bordeaux.

Pass of Leny.—On October 13th the London and Glasgow Engineering and Iron Shipbuilding Company launched from their Middleton yard, at Govan, an iron sailing barque of about 1,280 tons register, built to the order of Messrs. Gibson & Clark, Glasgow. The vessel is of the following dimensions:—Length, 235 ft.; breadth, moulded, 36 ft. 3½ in.; depth to ceiling, 21 ft. 6 in.

Kilmory.—On October 13th Messrs. Russell & Co. launched from their Kingston yard, at Port Glasgow, an iron sailing vessel of the following dimensions:—Length, 257 ft.; breadth of beam, 3 ft. 3 in.; depth of hold, 22 ft. 11 in.; and of 1,600 tons register. This vessel has been built to the order of Messrs. Kerr, Newton & Co. She will be engaged in the East India trade.

Hebe.—On October 14th Messrs. Scott & Co. launched from their yard, at Greenock, an iron screw steamer named the *Hebe*, which has been built to the order of the Ocean Steamship Company, of Liverpool. Her dimensions are as follow:—Length, 200 ft.; breadth, 30 ft. 9 in.; and depth, 20 ft.; her tonnage being 600. Her engines, which are 560 H.P., will be supplied by the builders. The *Hebe* is intended for the Singapore coasting trade.

Sardhana.—On October 20th Messrs. Russell & Co. launched from their Kingston yard, Port Glasgow, the *Sardhana*, an iron sailing barque of 1,120 tons nett register, owned by Messrs. W. and J. Crawford, Greenock, and named by Miss Crawford.

Itamaraty.—On October 15th Messrs. James & George Thomson launched from their yard, at Clydebank, a steel saloon paddle steamer named *Itamaraty*, for passenger traffic in the bay of Rio Janeiro. The vessel measures 300 ft. by 30 ft. by 7 ft. 6 in., and will be supplied by her builders with engines capable of driving her at a speed of 17 miles per hour. She is fitted with a complete awning deck, and will be furnished in a style suitable for the climate of Brazil, having accommodation for nearly 1,000 passengers.

LAUNCHES—Irish.

Queen's Island.—On September 22nd Messrs. Harland and Wolff launched from their shipbuilding yard, Queen's Island, Belfast, a very handsomely modelled steel barque, named the *Queen's Island*, and built to the order of Mr. Samuel Lowther, Belfast. Her dimensions are:—Length, 282 ft.; breadth, 40 ft.; depth of hold, 24 ft. Her tonnage is about 3,300 tons; her hull is entirely of steel. Being barque rigged, she will be a very handy vessel, and her fittings are arranged with a view to economy, and convenience in working.

Caloric.—On October 10th there was launched from the shipbuilding works of Messrs. Harland & Woolff, Queen's Island. Belfast, a screw steamship named the *Caloric*, 243 ft. long, 31½ ft. beam, and 15 ft. deep, built for the Belfast Steamship Company, Her sister ship, the *Optic*, is at present in course of construction for the same company. These two vessels were ordered by the Belfast Steamship Company some months since, and have been designed by the builders. They are to be fitted up with all the latest improvements that have been introduced into both cross-Channel and Transatlantic steamers. There will be accommodation for upwards of 100 saloon passengers on the three decks. Both ships will be illuminated with the electric light. As to the engines, they will also be supplied by the builders. The cylinders will be 35 by 70, with 45 in. stroke, capable of indicating 1,000 H.P. After the *Caloric* was launched she was put under the shearlegs in Abercorn Basin to receive her boilers, machinery, &c., and it is expected that she will be put on the service between Belfast and Liverpool at the beginning of the new year. The sister ship, the *Optic*, is approaching completion, and will be launched in the early part of November.

TRIAL TRIPS.

Wells City.—On September 22nd the new steel screw-steamer *Wells City*, built by the North of England Shipbuilding Company, Sunderland, had her trial run. The vessel, which is 280 ft. long by 36 ft. broad, and 23 ft. 6 in. depth of hold, has been built to the order of Messrs. Charles Hill & Sons, of Bristol, under the inspection of their manager, Mr. Bailey, and Captain Weiss, who has taken command of the vessel. The steamer has been fitted with engines on the triple expansion principle, embracing all the latest improvements for economic working, by Messrs. T. Richardson & Sons, of Hartlepool, and have been built under the inspection of Mr. Scott, Messrs. Hill's engineer. The vessel carries five winches, manufactured by Messrs. Clarke, Chapman & Parsons, of Gateshead; windlass by Emerson, Walker & Company, London; and steam steering gear by Messrs. Bow, M'Lachlan, & Company, Paisley. During the trial the vessel ran the measured mile at a speed of 11½ knots.

Combined Hopper and Dredger.—On September 25th the second combined hopper and dredger constructed by Messrs. Wm. Simons & Co., Renfrew, for the Belfast Commissioners, had a trial of her capacities in the wet dock, Port Glasgow. The buckets, which are capable of holding about a cartload, revolved at a rapid rate, and deposited the mud in the hold of the dredger, which can contain about 800 tons on a draught of 13 feet of water. At the expiry of an hour about 600 tons had been lifted, and the proceedings having given the utmost satisfaction, the dredger proceeded to the Holy Loch to deposit her cargo. The engines are compound, driving twin screws at great speed.

Torpedo.—On September 26th the steam ship *Torpedo*, built and engined by Messrs. Earle's Shipbuilding and Engineering Company, Limited, of Hull, for Messrs. Thomas Wilson, Sons & Co., of the same town, was taken on her trial trip. The vessel, which has been built for the coasting and continental trades, is 150 ft. long by 25 ft. beam by 13 ft. depth of hold, is classed A1* Liverpool, and has water ballast forward and aft for trimming purposes. The engines are Earle's three crank triple compounds having cylinders 14½ in., 22 in., 36 in., by 24 in. stroke, and worked most satisfactorily during the run, developing 390 H.P., and driving the ship at a speed of 11 knots. Hodgkinson's mechanical stoker is fitted to the boiler and worked very effectually.

Alexandra.—On September 30th the steam tug *Alexandra*, built by Messrs. Earles' Shipbuilding and Engineering Company, Limited, of Hull, to the order of the Hull and Barnsley Railway Company, was taken on her trial trip. She is 72 ft. by 16 ft. 6 in. by 8 ft. 6in., and is fitted by the builders with their three crank triple compound engines having cylinders 11½ in., 17 in., 30 in., by 21 in. stroke. These latter gave entire satisfaction and worked most smoothly and efficiently. The vessel is fitted with a steam fire engine of good size and power, and is intended for service in the Alexandra Dock at Hull.

Hecla.—On October 1st the *Hecla*, 6, torpedo storeship, was re-commissioned at Keyham, and was afterwards taken outside Plymouth breakwater for a preliminary trial of her machinery, the force of the wind being too great to admit of her making the runs at the measured mile. Captain Kelly, of the *Indus*, was in charge of the ship. The short trial showed that a newly fitted screw would materially add to the power and speed of the ship. Mr. Watson, chief engineer of the *Northumberland*, had charge of the engines, assisted by Mr. A. Wilson, chief engineer of the ship. Mr. Charles Rudd, chief engineer, watched the trial on behalf of the steam branch of the dockyard, and Mr. J. Black, assistant constructor, represented the constructive department.

Naniwa Kan.—On October 3rd this cruiser, the first of two sister vessels which Sir W. G. Armstrong, Mitchell & Co. recently launched from their Low Walker yard for the Japanese government, was taken to sea for a preliminary trial of her machinery, which has been manufactured by Messrs. R. & W. Hawthorn. The compasses having been adjusted, the vessel was first tried with natural draught in her boilers, and attained a speed of 17½ knots per hour, after which the stokeholds were put under forced draught, and a trial of three hours' duration made in this condition, resulting in a speed of 18¾ knots per hour. The boilers were not, however, pressed to their full power, so that a still higher speed will yet be attained. Notwithstanding that this was the first time the vessel had been at sea, the machinery worked throughout the day with the greatest smoothness and regularity, in fact without a hitch of any kind. The vessel, being now in an advanced condition, will soon be entirely ready for sea, when her official trials will take place. The *Naniwa Kan* is a first-class cruiser of the protected type, having 3,650 tons displacement, and, considering her great speed and heavy armament, is actually the most powerful vessel of her kind afloat, not excepting even the famous *Esmeralda*, of which the present vessels are practically an enlarged edition. Her speed, however, is not greater than that of the *Mercury*.

Black Pearl.—On October 6th the schooner-rigged steam yacht *Black Pearl*, which has been built by the Culzean Shipbuilding Company to the order of the Right Hon. the Earl of Pembroke, went on her official trial trip. Her machinery has been supplied by Messrs. Rankin & Blackmore, of the Eagle Foundry, Greenock, and consists of a pair of compound surface-condensing engines, of 60 H.P. nominal, which are supplied with steam by a multitubular boiler at 90 lbs. working pressure, and indicated on trial 270 H.P. The *Black Pearl* is fully rigged as a schooner. A Maudslay's patent feathering brass propeller has been fitted into her to enable the blades to be turned fore-and-aft, or feathered, when under canvas only. Although the weather was very unfavourable, the yacht proceeded down the firth, and ran a series of runs upon the measured mile, giving an average speed of 10·7 knots, which was deemed most satisfactory by all concerned. The *Black Pearl* is commanded by Captain R. Bond, who has been for four years in command of the steam yacht *Titania*, the property of the Marquis of Ailsa.

Knight of St. John.—On October 7th the steel steamship *Knight of St. John*, which has been built to the order of Messrs. Greenshields, Cowie & Co., of Liverpool, by Palmers' Shipbuilding and Iron Company (Limited), was taken to sea for her trial trip. The following are the dimensions of the vessel:—Length, 330 ft.; breadth, 43½ ft.; depth of hold, 29 ft.; carrying capacity, 4,700 tons deadweight. The steamer is fitted with triple expansion engines, and they performed their work in a very satisfactory manner during the trial. The speed obtained on the measured mile was equal to 12¼ knots an hour. The vessel was built under the supervision of Captain Muir, of Liverpool, and the engines were constructed under the personal superintendence of Mr. Goodwin, consulting engineer, also of Liverpool.

Suez.—On October 8th the steamer *Suez* had a short trial at sea, leaving West Hartlepool about 11 a.m., and running along the coast a few miles, then proceeding up the river Tees to Middlesboro', where she docked about 2 p.m. the same day. The *Suez*, which is a screw steamer of 3,000 tons gross, has been built by Messrs. William Gray & Co., West Hartlepool, to the order of Messrs. T. Appleby & Co., of the same place. She is 285 ft. long, over all, and 275 between perpendiculars, 37 ft. beam, 19 ft. 11 in. depth of hold. She is built entire of Siemens-Martin's steel. The bridge is carried forward as far as the foremast, leaving a very short well. The top-gallant forecastle is left open, and the crew are accommodated under the fore end of the bridge deck. The boats are carried on beams about 7 ft. above the bridge deck. Four of Messrs. Clark, Chapman & Co.'s horizontal steam winches are fitted, which are supplied with steam by two large donkey-boilers placed in the stokehole. J. Beck's patent steam steering gear is fitted. It is claimed for this steering gear that it is the simplest, most effective and compact steering gear in use, and it certainly appears to possess these properties to a large degree. The use of the Helical form of teeth is a good point. The "engine" is exceedingly compact and this without interfering with its simplicity; the common slide valve being used, removes a difficulty which is sometimes felt in case of accident when more complex forms of valves are used; the change from hand to steam or from steam to hand is both simple and quick; the introduction of the chain barrel in place of the Gipsy wheel, although making the gear longer fore and aft, is in other respects an improvement. During the trial-trip it was found that the helm could be put hard-over from port to starboard in about 25 seconds, while the ship was going at full speed. The engines of this steamer are supplied by Messrs. Black & Co., Limited, Stockton-on-Tees, and are on the triple expansion type, 180 N.H.P., the pressure of steam being 150 lbs. During the trip they worked in a very satisfactory manner. driving the ship at the rate of 11 knots an hour. There was a rather large company on board, including several gentlemen interested in ship-building and engineering, who spoke very favourably of the vessel and her equipment.

Basil.—On October 15th a tender left the Prince's landing-stage with a select party of gentlemen, who proceeded on board the steamship *Basil*, belonging to Messrs. Alfred Booth & Co. The vessel has been fitted with new engines and boilers of the compound surface-condensing inverted direct-acting type, cylinders 27 in. and 55 in. diameter respectively, with a stroke of 39 in., and boiler constructed of Siemen's steel, carrying a working pressure of 90 lbs., with all the most modern improvements. In addition to this, the hull has received a thorough overhaul, new decks, and a large midship-house, containing all the necessary accommodation for officers, &c. A new steam-steering gear has also been fitted. The vessel proceeded down the river, the engines working very smoothly at 72 revolutions per minute, and on the measured mile her average speed was 11½ knots per hour, indicating 850 H.P. All on board expressed themselves highly satisfied with the vessel's performance. The whole of the above work has been carried out under the superintendence of the company's engineer, Mr. Beckett, and Mr. Garland, their marine superintendent, by Messrs. David Rollo & Sons, Fulton Engine Works, Liverpool.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from August 21st to September 21st, 1885.

11235 C. T. Colebrook. Rotary engines or motors.
11245 D. D. Napier. Steam cargo whips or winches.
11248 J. C. Jopling. Steam boilers.
11250 J. M. Gray & D. Purves. Cylindrical furnaces.
11266 J. H. Konter & J. Chaffaud. Water break for stopping ships.
11276 Lake (C. H. Cary) Rotary engines and pumps.
11277 R. Harrison & W. Oliver. Obtaining and applying motive power.
11291 L. P. Neilsen. Self-acting chocks for supporting ships' boats.
11295 J. Wheelock. Steam engines.
11309 C. C. Sullivan. Dredging.
11329 P. Teague & W. H. Thomas. Pumps.
11338 Busche (R. Rieth). Self-recording ship's log.
11354 C. Jackson. Cocks and taps.
11358 R. & H. B. F. Barker. Consuming oils for the generation of steam.
11359 R. Barker. Heating furnaces for smelting or roasting.
11372 C. H. Ancill. Self-closing connection for valves.
11377 E. Korting. Apparatus for elevating liquids by means of steam or compressed gases.
11378 J. W. Clarke. Valves.
11384 H. S. Lancaster. Actuating and reversing the slide or other steam-distributing valves of steam engines.
11411 J. Sephton. Boiler.
11414 J. J. Pearson & T. H. Taylor. Increasing the efficiency of pumps.
11415 J. G. Grant. Automatic sighting of heavy guns.
11416 J. Murrie. Motive-power apparatus.
11423 W. P. Jones. Cartridge packing and loading box combined.
11438 E. E. Mann. Signal buoys for sea coast and other purposes.
11440 Haddan (S. Berry). Stuffing boxes for steam engines.
11465 S. Butterworth. Regulating the speed of motive-power engines.
11469 R. Richardson. Valves.
11482 J. Murrie & J. Thomson. Motive-power apparatus.
11529 E. L. Kitchingman & A. Andrews. Waterproof and anti-corrosive composition suitable for coating ships' bottoms.
11543 G. W. Carr & J. Dickinson. Anti-fouling composition for protecting and preserving ships' bottoms.
11546 M. W. Aisbitt. Tow hooks.
11563 J. Murrie. Motive power apparatus.
11575 G. L. Schultz & D. Campbell. Buoys and shells for submarine mines or torpedoes.
11614 T. Johnson. Serving rope for the rigging of ships.
11632 A. J. Lehmann. Horizontal fluid steam generators.
11643 W. Thorp. Lubricators.
11656 A. T. Booth. Governors.
11668 J. A. Hopkinson and J. Hopkinson. Lubricating apparatus
11673 H. Hallworth and J. L. Shorrock. Packing for the glass tubes of water gauges.
11679 R. Scott. Application of air, water, or other fluids as a motive power.
11685 J. McEwen. Blow back safety for aerated water condensing cylinders.
11686 J. P. Gibbins. Charge receptacles or cases for submarine mines.
11708 H. St. G. Boswell. Case for clinical thermometers.
11709 Edwards (G. Bernard). Pumps.
11711 Thomas (H. S. Thomas). Armour plating of vessels.
11715 T. Robinson. Shafts for screw propellers.
11717 J. G. Joicey and M. Watson. Governing apparatus for steam or other engines.
11718 W. H. Thompson. Machinery and apparatus for raising and forcing water and other liquids or fluids, and transmitting motive power.
11720 Barlow (G. Dietz & E. Tamsen). Rotary engines.
11735 W. Robson. Steam generator.
11746 Sir E. J. Reed. Mounting and working large guns.
11748 J. N. Cosbey. Expanding life-saving mattress, hammock, and travelling bag.
11749 Thompson (W. Voit). Counting or registering the strokes of steam engines.
11756 E. Wigzell and J. Pollis. Governors.
11759 Imray (A. Frager and the Société, Michel et Cie). Water meters
11774 B. C. Waite. Steam engines.
11781 C. S. Madan. Vacuum brake gauges or indicators.
11800 F. F. E. Elmore. Manufacturer of tubes, cylinders, boilers, etc.
11801 J. McAllister. Steam boilers.
11823 W. B. Thompson. Compound marine and other engines.
11835 G. Walker. Feed water heater.
11839 W. H. Wheatley & J. W. McKenzie. Steam Engines.
11848 E. Brown. Propelling steam and other ships.
11863 F. W. Richardson. Means of propelling ships.
11868 G. Fletcher. Lubricators.
11882 Sir W. Vavasour. Self-acting valve.
11885 W. H. Wheatley & J. W. McKenzie. Valve gear for steam engines.
11888 G. Kindon, F. C. Simpson, J. B. Denison & E. F. Denison. Rotary engine.
11891 Haddan (G. Delagneau & J. H. Graham). Piston packings.
11905 W. F. Goreham & W. W. Hewitt. Generating steam.
11922 H. Grunow & T. H. Hodge. Steam trap.
11928 J. S. Dunn. Lubricators.
11944 Edwards (F. Tessier). Obtaining motive power.
11963 A. C. Henderson. Rotary double action pumps.
11981 H. R. Lumley. Rotary motor.
11994 S. S. Allin. Water motors.
12007 C. S. Snell. Safety valves.
12008 C. S. Snell. Hydraulic valves.
12009 S. F. Smith & D. Waude. Swimming apparatus.
12016 W. Barry and G. W. Jones. Indicators for water-gauge glasses
12021 T. Elcoate. Removing scum from steam boilers
12038 G. Sellers. Testing the valves of steam and other engines.
12039 G. Sellers. Taking indicator diagrams from steam and other engines.
12078 Wise (J. F. Bonnaterre & — Avon). Utilising the pitching, heaving, and rolling motions of ships or navigable vessels.
12120 J. Thom & D. J. Howells. Reversing valve gearing of steam engines.
12153 G. Rodger. Floats for paddle wheels.
12161 C. Whitfield. Furnace grates.
12171 E. H. A. Heinke. Water level indicators.
12173 R. Richardson. Valves.
12181 B. Faymonville. Electro-magnetic speed registers.
12182 G. Hurn. Mode of coating riggers.
12183 H. F. Clark. Breech-loading firearms.
12195 Thompson (A. Backus, jun.). Furnaces.
12198 E. Field. Steam engines.
12204 S. Hannah. Steel ships' and other steel plates.
12216 H. W. Pendred. Single-acting steam engines.
12218 G. Andrews. Method of carrying cartridges.
12228 E. H. B. Stephenson. Use of chlorate mixture in cartridges
12240 Sir W. Thomson. Navigational sounding machine.
12258 A. Lowcock & T. Sykes. Fuel economisers.
12262 G. Sellers. Steam or other fluid pressure engines.
12266 J. Tall. Ships' telegraphs.
12270 T. Marsh & J. Marsh. Oil cans.
12275 J. W. & F. Wilson. Marine propellors.
12280 T. Kennedy. Self-closing valves.
12282 J. W. Balet. Marine governor.
12284 W. Hillyard. Ships' warping or other capstans.
12285 D. Fergusson. Water meters.
12297 B. Hawerkamp. Safety valve for steam boilers.
12300 W. Brandsma. Pump.
12304 Thomson (R. H. Earl). Lowering and raising ships' boats.
12310 J. Gwynne & D. H. Morton. Centrifugal pumping machinery.
12327 W. W. C. White. Wind gauge for firearms.
12322 F. H. Smith. Preventing blow downs in chimney flues.
12324 B. M. Dawes. True north compass.
12329 T. Winter. Light feed lubricator.
12333 T. Martin. Valved and air-tight safety innocuous coffins for burials at sea, &c.
12336 R. W. Hewett. Application of a wind blast to flames.

12352 G. Kingdon, F. C. Simpson, J. B. Denison, & E. F. Denison. Steam boilers.
12355 W. Edmunds. Blast furnaces.
12359 T. Mudd. Steam engines.
12362 J. I. Thornycroft. Steering apparatus for vessels.
12384 J. F. Waddington. Electrical submarine vessel.
12385 E. R. Royston. Steam engines.
12404 R. Parry & C. B. Phillips. Armour for ships of war, &c.
12409 Barlow (J. W. Johnson). Regulating the speed of steam or water engines.
12418 A. Bachoneyer. Sectional boilers.
12429 G. Rung. Speed indicators.
12435 W. J. Jeffery. Inspecting the Martini-Henry and other fixed barrelled rifles from the breech and muzzle.
12447 H. Dent. Steam boilers.
12450 F. W. Ticehurst. Indicating the comparative strengths of powder charges.
12455 J. Rough. Boiler tube stopper.
12476 J. Shaw & N. Arthur. Promoting draught and combustion and preventing smoke in steam boiler and other furnaces.
12512 W. Smith. Constructing the hulls of ships, &c.
12531 A. Egestorff & L. Hermann. Preserving fish in fishing smacks.
12537 R. Morrin. Coverings or coatings for propeller blades, &c.
12540 Morrison (J. G. Hathaway). Pulverizing fuel and feeding it to furnaces.
12574 H. J. Worssam. Steam hoists.
12575 J. G. Claude-Mantle. Metallic and other packing and stuffing boxes for piston rods, &c.
12578 C. H. Tricker. Determining the position of valves, &c.
12586 J. Phillips & W. F. Phillips. Screw down valve.
12590 W. G. Tranter. Revolver pistols and rifles.
12613 G. Stavers. Signalling at sea, &c.
12614 R. Matthews. Piston valves for steam engines.
12627 Clark (M. Honigmann). Working steam engines.
12633 R. J. Worrall. Bearings or pivots of gates, ships' rudders, &c.
12639 H. P. Fenby. Metallic rings and tubes.
12640 J. Mason. Utilising the power of tides.
12644 F. J. Jones. Boiler furnaces.
12675 J. Reid. Means for expanding the packing rings of pistons.
12682 Lake (H. Piron). Lubricator.

Miscellaneous.

Mr. Donald C. Grant, one of the Porth Bridge staff, is bringing out a new form of signal for use at sea to indicate to other ships the direction of movement of the helm, so as to avoid collision with ships close up. He does not propose to supersede the side lights at present employed, but only to supplement them. The officer on watch is supplied with a couple of signals small enough to be carried in a breastcoat pocket of ordinary capacity. Should he wish to indicate that his vessel is on the port tack, he takes a signal—with a round handle and coloured red—from his pocket and fires it by giving it a slight tap. The result is a brilliant red light. After this light has burned for about thirty seconds it explodes a small maroon, the report of which can be heard a mile off; and after this the light continues to burn for another thirty seconds. The process of firing the starboard tack signal is, of course, the same, the result being a green light, but in this case the handle is square, this difference of form making it easy the dark to distinguish the right signal to be employed.

The annual meeting of the firm of W. G. Armstrong, Mitchell, and Co., was held on 29th September. The profit on the year's operations amounted to £160,692 17s. 6d. being £59,000 above last year. This allows of a dividend of 8 per cent.

The completion of new quays at Antwerp marks an epoch in the commercial history of that port. The new quays are situated on the right bank of the Scheldt and are over two miles in length. They were constructed partly at the expense of the State and cost over £4,000,000. The chief engineer was M. Loisseau.

Messrs. F. Bellville & Co. have received an order from the French Admiralty for the supply of boilers of 2,100 H.P., constructed on their inexplosible tubular system, to the cruiser *Rigault de Genioully*. Many of our readers will remember that an explosion of the ordinary cylindrical boilers previously fitted to this vessel took place on November 19th last, during the voyage out to Formoso.

BOARD OF TRADE EXAMINATIONS.

Note.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

September 19th, 1885.

Bailey, J. J. ..... 2C Southamt
Cummings, John 1C Cardiff
Davidson, James 1C Dundee
Drake, F. W. .. 2C London
Duncan, David .. 2C Leith
Greening, W. A. 1C London
Greig, James .. 1C Dundee
Griffiths, H. T. .. 2C Liverpool
Hall, H. ...... 2C Sunderlnd
Hammonis, J. F. 1C Liverpool
James, F. C. ... 2C Cardiff
Keehner, J. G. .. 2C Sunderlnd
Kinrean, John .. 1C Liverpool
Lea, William .. 2C London
Lun, James .... 2C ,,
Louttet, Sam H. 1C ,,
Marshall, F. J. .. 1C ,,
Marshall, P. .. 2C Liverpool
Page, James .... 1C Dundee
Pearson, H. M. .. 1C Liverpool
Piews, W. H. .. 1C Cardiff
Purvis, Andrew .. 2C London
Raftopoulo, C. .. 1C Sunderlnd
Rance, T. C. .... 1C London
Roberts, R. .... 2C Liverpool
Scott, Charles .. 2C ,,
Shannon, Alex .. 2C ,,
Stokes, P. ...... 2C ,,
Stephenson, E. .. 1C ,,
Stark, D. L. .... 1C London
Thompson, John 1C Cardiff
Watson, Thomas 1C Dublin
Wright, Charles 2C London
Wilkie, J. ...... 2C Liverpool
Kennedy, David 1C Liverpool
Millar, G. E. .... 2C London
Morrice, James .. 2C ,,
Salt, Richard .. 2C ,,
Shepherd, G. B. 2C Liverpool
Thorpe, Wm. R. 1C London
Venables, Edwin 2C Liverpool

September 26th, 1885.

Burns, Philip .. 1C Glasgow
Catto, George .. 1C Aberdeen
Donovan, John .. 1C London
Fenny, John C. .. 2C N Shields
Gray, Robt. .... 1C Glasgow
Haig, Robt. .... 2C ,,
Hendd, Peter .. 1C ,,
Humphrey, John 1C ,,
Lawrance, David 1C ,,
McCallum, Robt. 1C ,,
McKinnon, D. .. 1C ,,
McNicol, Wm. .. 2C ,,
McPherson, Peter 1C ,,
Seed, Wm. ...... 1C N Shields
Waller, J. ...... 1C ,,
Whitley, Geo. .. 2C Belfast
Winterburn, W. .. 1C N Shields

October 3rd, 1885.

Anderson, J. .... 1C N Shields
Blair, H. L. .... 2C London
Clift, G. T. .... 2C N Shields
Ewing, James .. 1C Glasgow
Gladstone, T. J. 2C London
Gilbertson, A. .. 1C Glasgow
Gracey, Wm. .. 2C Belfast
Hall, Frederick .. 2C N Shields
Harper, C. W. .. 2C Aberdeen
Harrison, John C. 1C Liverpool
Jeffery, Ernest .. 1C ,,
Jennings, R. V. 1C London
Jones, S. G. .... 2C ,,

October 10th, 1885.

Beacroft, G. F. .. 2C Liverpool
Bell, T. .... 2C N Shields
Bell, W. ...... 1C Dublin
Findlay, D. L. .. 2C Greenock
Gillan, Jas. .... 2C Liverpool
Gilvray, H. .... 2C N Shields
Goss, G. .... 2C Liverpool
Grieve, Alex. .... 2C London
Irving, C. ...... 1C Liverpool
Kempt, Robt. .. 1C London
Leftwich, J. L. .. Ex C Liverpl
Middleton, J. R. 2C N Shields
Morrison, J. .... 2C Greenock
Rankin, F. ...... 1C ,,
Rackshaw, G. .. 1C Liverpool
Raxton, F. W. .. 2C ,,
Simpson, W. .... 2C ,,
Westwater, Alex 2C Greenock

October 17th, 1885.

Adam, Robert .. 2C W Hartpl
Ainsworth, W. H. 1C N Shields
Armstrong, R. W. 1C ,,
Bell, Joseph .... 1C Liverpool
Blair, Wm. .... 2C N Shields
Buckwell, G. W. 2C London
Bulman, Wm. .. 2C N Shields
Cameron, John .. 2C Glasgow
Croft, A. W. .. 2C N Shields
Douglas, John .. 2C Glasgow
Embley, Robert 2C Hull
Gibson, H. T. .. 2C Glasgow
Gravell, D. H. .. 1C N Shields
Greenshields, J. 2C Glasgow
Hardy, Wm. W. 2C N Shields
Hay, Charles .. 1C Glasgow
Henderson, A. .. 2C N Shields
Henderson, Wm. 2 C W Harpl
Hodgson, Robt. 2C ,,
Knight, B. T. .. 2C London
MacKenzie, John 2C Leith
Malloch, Wm. .. 2C ,,
McDonald, Wm. 2C ,,
McIntyre, Peter 2C Glasgow
McLean, Alex .. 2C London
Meaker, C. J. .. 2C Liverpool
Mill, David .... 1C Glasgow
Miller, Robert .. 2C Leith
Milne, John .... 2C Glasgow
Milne, P. A. .... 1C London
Morison, Andw. .. 2C Glasgow
Roberts, J. E. .. 2C London
Robinson, Wm. .. 1C Hull
Robson, Geo. .. 1C N Shields
Smith, Joseph F. 2C London
Stacks, Robert .. 1C Leith
Sundstream, A. R. 2C N Shields
Taylorson, R. J. 2C W Hartpl
Turner, G. J. .. 1C Liverpool
Walker, M. G. .. 2C W Hartpl
White, Wm. F. .. 2C N Shields

Six iron and steel passenger steamers for India have recently been sent out by Mr. Edward Hayes, launch builder, Stony Stratford, to work on the Irrawaddy; one stern-wheeler, and five twin screw steamers—size, 70 ft. long by 14 ft. beam.

The Marine Engineer.

LONDON, DECEMBER 1, 1885.

EDITORIAL NOTES.

THERE is much difference of opinion in engineering circles as to the advisability, or otherwise, of frequent hydraulic testing of boilers. By reference to our former issue, our readers will there see that we point out that one of the frequent dangers to the collapse of boilers is the deformation in shape of the flues, and that absolute collapse usually ensues, perhaps unexpectedly at the last, after considerable warning has been given, by some alteration from the true circle of the flues. We also pointed out that the tendency of a flue to collapse is much increased by any alteration in shape from that of the true cylinder. From these remarks it will be easy to see that much danger may result from the excessive hydraulic test, which may have deformed the shape of the flues during its operation. The result, under such circumstances, will be that the boiler is much weaker after the test than before, and that so far from the test having afforded any proof as to the security of the boiler, the test itself has rather proved the cause of the ultimate collapse. Considerable attention is being given to the subject at the present moment in the United States by inquiry amongst the members of the engineering profession. The replies elicited have been very meagre in number. Of these, some report themselves as totally opposed to hydraulic tests of any kind. Another replies that he has seen a boiler tested to 120 points by hydraulic pressure that leaked at every joint, but was perfectly tight under a similar pressure of steam. Of all those who advocate an hydraulic test at all, decided preference is given to hot water over cold—as giving proper expansion to the parts; and favour the introduction of the hot water direct, rather than the heating of cold water in place. They further all concur in limiting the excess of over-working pressure to which the test is to be carried, a comparatively moderate amount above working pressure, in no case exceeding 25 points per square inch above high rates of working pressure, and 50 per cent. in excess of their rated pressures when this is under 100 points. In these deductions we cannot but concur. Test by hydraulic pressure has its essential place and advantages when a boiler is first constructed, in indicating imperfect joints, and where the places of weeping occur, which would otherwise escape notice. The test of parts during construction is to our mind a much better guarantee as to the ultimate strength of the boiler when completed than any excessive hydraulic strain. The deterioration also of a boiler is far better ascertained by direct frequent examination from time to time, which, if properly conducted, is sure to bring to light any pitting or weakening of plates or stays by ordinary use. Any defect thus ascertained by direct examination should be at once put right and repaired, and not left for test under hydraulic pressure. The engineering world at large has had by this time ample experience in the strength of ordinary boiler plates and rivets, where known dimensions are employed under known pressures, provided the materials are good of their kind and are kept in perfect maintenance without depending upon any hydraulic test for the confirmation of their views.

BRAZIL seems to be taking a very leading position amongst new countries in their anxiety to adapt themselves to modern requirements in ship and ironclad building, and to avail themselves of all modern improvements therein. It is now stale news that Brazil has latterly become proprietor of some of the most perfect ironclads afloat, either with regard to the perfection of their hull and mechanism, or their eminent fighting qualities. We notice now that she is not desirous of being left behind even in peaceful pursuits where they are open to improvement by the best modern appliances and assistance. We refer in particular to steam trawling, which has now been for so many years an accomplished fact in our fisheries in the North Sea and elsewhere. Two apparently very excellent and powerful steam trawlers, intended for service on the cost of Brazil, have lately been launched and completed by Messrs. Cochran & Co., of Birkenhead, in a very satisfactory manner. They are handsome and perfect vessels, fitted with every modern improvement for trawling under the most economical conditions. Their hulls are 90 ft. in length, with a depth of 9 ft., and a beam of 17 ft., having a tonnage of 115, and are engined so as to develop 10½ and 9 knots respectively. The steamer with the higher speed is intended to do the carrying business in transferring the fish from the fishing ground to Para, whereas the slower speeded steamer will be generally occupied on the fishing ground in trawling. They are fitted with every mechanical appliance for working the heavy trawling gear in shape of a powerful steam winch in conjunction with veering bitts and guide rollers in the bulwarks, while the aft end of the beam will be controlled by means of blocks on a strong davit on the quarter. The fish hold also is insulated in a most improved manner, and cooled so as to enable the

fish to be preserved in a good and marketable condition even in hot equatorial climates. The refrigeration is effected by one of Lightfoot's patent universal dry air refrigerators, which is placed in the engine room, and which produces most successful results, the trial showing that the fish room can easily be reduced to below freezing point with a couple of hours' running. Every mechanical appliance has thus been carefully adapted to the purpose in view, and the trawlers promise to be most efficient in developing and maintaining a cheap and plentiful fish supply to the seacoast towns of Brazil, where no doubt there is an ample and remunerative market.

During the course of modern improvement in marine engine building much importance has been attached to the use of steam with high grades of expansion. Remarkable results in economy have no doubt accompanied the use of high boiler pressures and of compounded engines, which have generally been associated therewith, working at high ranges of expansion. A great deal of the credit of such economy has been given either purely and simply to the principle of compounding employed in the engines, or to the high degrees of expansion utilised, without regard to the great simultaneous improvements in boiler construction and the consequent much higher initial steam pressures which were thereby rendered possible. As a consequence of these marked improvements in economy there has been a tendency in the engineering world generally to rush to extremes, both in high initial pressures and also to great ranges of expansion. These efforts have not always been attended with any marked success, and it is well for us to point out a pitfall in such matters into which engineers may easily come to grief.

The practical disadvantages attending extremely high pressures are already very well known in the form of the excessive working heat thus necessitated, the charring of lubricants, and the consequent cutting or goring of wearing surfaces. We need not, therefore, say much more on this head, but desire to point out a popular delusion that unlimited ranges of expansion always continue to confer increased economy in working. This delusion, which is very common among engineers, arises from the theoretical estimation of work that may be derived from continuing the expansive working of steam to a great extent. Such theoretical estimation always shows that there is a continued gain in working in the cylinder as the elastical expansion continues. Facts, however, have in many instances proved that this further gain is not practically realised when very moderate degrees of expansion are exceeded, and we would point out two specific reasons why this want of practical realisation of effective work is to be expected:—1st. It has long been known that waste and condensation increases as the square root of the ratio of expansion, or to the square root of the time of exposure, that is to say, in common parlance, condensation and waste increase very rapidly as the degree of expansion increases, and very soon will tend to altogether nullify the further theoretical work developed therefrom. 2nd. A still more important consideration is this, that all engines have two distinct characters of load upon them, one of which is the dead load to effect the movement of the mechanism or plant itself, and the other is the live load, or net work over and above. Now it is well known in marine engines that some 25 to 30 °/₀ of the whole work developed in the cylinder is absorbed in the dead load of the engine, that is to say in driving itself and the propeller shaft and propeller against dead frictional resistance and waste without serving to produce any effective work therefrom. It should be obvious on consideration that the most practical economical engine is that which produces the largest proportion of net work as compared with dead load during ordinary work. High ranges of expansion mean a long stroke or a large number of revolutions in the development of work from a given volume of steam as compared with what would be the case were that steam used in concentrated form without any very great expansion. We would point out that dead load is proportional to the number of revolutions required to effect a certain amount of work, and that if therefore in high ranges of expansion double the number of revolutions are required to effect it, as compared with those necessary to develop the same net work with lower ranges of expansion, then the engine is subjected to double the dead load in carrying into effect the net work resulting from high ranges of expansion. The increasing proportion of work thus done upon dead load instead of upon net work soon serves to absorb any apparent gain resulting from high expansions in the cylinder. We should feel disposed to say that this limit of practical efficiency from expansion is reached when the ratio is from three to four times, and that any utilisation beyond this ratio is mere delusion. We should be glad to hear from any of our practical readers in charge of engines, how far they may have noticed this peculiarity in the management of their engines, and should be glad to collect for the benefit of the profession at large such data, from a practical source, as might help to fix this limit of economical expansion from actual experience.

THE *Great Eastern* has been sold at last. This celebrated steamship was put up to auction at Lloyd's Captains' Rooms, on the 28th of October, by order of the High Court of Justice. The vessel was described as of 22,927 tons, builders' measurement, 18,915 tons gross, and 13,344 tons net register. She was built from designs and under the personal superintendence of Isambard Brunel, by the celebrated firm of Scott, Russell & Co., in 1858. Her paddle engines are 1,000 N.H.P., and her screw engines are 1,600 N.H.P. Her length is 679·6 feet, with a breadth of 82·8 feet, depth 60 ft., and she is now lying at Milford Haven. Such a vessel has evidently an enormous capacity for cargo carrying, and great accommodation for first, second, and third class passengers, her saloon and state room accommodation being unrivalled. She is, however, too unwieldly for general traffic, and her engines and boilers, however good for their period, do not fit her to compete with the present high rate of speed required for ocean liners. She was made considerable use of at one time as a telegraph ship, until the telegraph companies provided for their own use vessels fitted with more perfect appliances and fittings, while at the same time, less costly in maintenance and work. There was very little apparent desire to become possessors of this vessel, if one may judge by the slackness of the bidding, and this is not much to be wondered at, if one considers how likely she will prove to be a white elephant on the hands of any propriety. The bidding, which commenced at £10,000, increased by very small and minute stages up to £26,200, at which the vessel was disposed of to Mr. Frederick De Mattos, a city merchant. A great deal of curiosity is excited as to what Mr. De Mattos can possibly intend to do with her, now he has got her, and we can only suppose that it will take possibly some such form as that of a floating exhibition. We shall be glad, however, to see some practical use made of such a creditable monument of engineering skill, short of breaking her up.

LLOYD'S.—Application is intended to be made by the corporation of Lloyd's, in the ensuing session of Parliament, for an Act to extend and enlarge their powers as regards the "collection, publication, and diffusion of intelligence," and to provide that the publication and diffusion of any such intelligence shall be deemed to be a privileged communication from them. By other clauses power will be sought for to authorise them to establish signal stations and to erect signal houses, with all requisite telegraph and telephone wires, appurtenances, &c., "at such places on the coast of Great Britain and Ireland and the islands appertaining or belonging thereto as they shall think fit, and to maintain and work the same," such powers, however, together with the taking of lands or houses for the purpose, to be exercised only with the approval of the Board of Trade.

THE PREVENTION OF COLLISIONS AT SEA.

THE Admiralty have at length revised the Regulations for the Prevention of Collisions at Sea, and have issued an important Fleet Circular dealing with the question in detail, and all officers of the military branch are ordered to make themselves thoroughly acquainted with the new instructions forthwith.

The captain shall not intrust the charge of a ship when under way to any officer, whether confirmed or acting, or to any other person, unless he has satisfied himself that such officer or other person is acquainted with them. Every steamship which is under sail and not under steam is to be considered a sailing ship; and every steamship which is under steam, whether under sail or not, is to be considered a ship under steam.

A sea-going steamship when under way shall carry (*a*) on or in front of the fore-mast, at a height above the hull of not less than 20 ft., and if the breadth of the ship exceeds 20 ft., then at a height above the hull not less than such breadth, a bright white light, so constructed as to show a uniform and unbroken light over an arc of the horizon of 20 points of the compass, so fixed as to throw the light ten points on each side of the ship, and of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least five miles; (*b*) on the starboard side a green light, so constructed as to show a uniform and unbroken light over an arc of the horizon of ten points, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible under the same conditions as above for a distance of at least two miles; (*c*) on the port side a red light to throw a light from right ahead to two points abaft the beam on the port side, and visible for at least two miles; (*d*) the said green and red lights shall be fitted with inboard screens projecting at least 3 ft. from the light, so as to prevent these lights from being seen across the bow.

A steamship, when towing another ship, shall, in addition to the side lights, carry two bright white lights in a vertical line one over the other, not less than 3 ft. apart, so as to distinguish her from other steamships. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light which other steamships are required to carry.

A ship, whether a steam or a sailing ship, which from any accident is not under command, shall at night carry in the same position as the white light, and, if a steamship, in the place of that light, three red lights in globular lanterns, each not less than 10 in. in diameter, in a vertical line one over the other, not less than 3 ft. apart, and visible at a distance of at least two miles; and shall by day carry in a vertical line one over the other, not less than 3 ft. apart, in front of, but not lower than, her fore-mast head, three black balls or shapes, each 2 ft. in diameter; (*b*) a ship, whether a steam or sailing ship, employed in laying or in picking up a telegraph cable, shall at night carry in the same position as the white light which steamships are required to carry, and if a steamship in place of that light, three lights in globular lanterns, each not less than 10 in. in diameter, in a vertical line one over the other, not less than 6 ft. apart; the highest and lowest of these lights shall be red and the middle white, and they shall be of such a character that the red lights shall be visible at the same distance as the white light. By day she shall carry in a vertical line one over the other, not less than 6 ft. apart, in front of but not lower than her fore-mast head, three shapes not less than 2 ft. in diameter, of which the top and bottom shall be globular in shape and red in colour, and the middle one diamond in shape and white; (*c*) the ships referred to when not making any way through the water shall not carry the side lights, but when making way shall carry them; (*d*) the lights and shapes required to be shown are to be taken by other ships as signals that the ship showing them is not under command, and cannot therefore get out of the way. The signals to be made by ships in distress and requiring assistance are subsequently described.

A sailing ship under way, or being towed, shall carry the same lights as are provided for a steamship under way, with the exception of the white light, which she shall never carry.

Whenever, as in the case of small vessels during bad weather, the green and red side lights cannot be fixed, these lights shall be kept on deck, on their respective sides of the vessel, ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side. To make the use of these portable lights more certain and easy, the lanterns containing them shall each be

painted outside with the colour of the lights they respectively contain, and shall be provided with proper screens.

A ship, whether steam or sailing, when at anchor shall carry 20 ft. above the hull a white light in a globular lantern of not less than 8 in. in diameter and capable of showing a uniform light visible all round the horizon at a distance of at least one mile.

A pilot vessel, when engaged on her station on pilotage duties, shall not carry the lights required for other vessels, but shall carry a white light at the mast-head visible all round the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed 15 minutes. A pilot vessel, when not engaged on her station, shall carry lights similar to those of other ships.

A number of regulations are also made for the guidance of fishing and other open boats and trawlers.

A steamship shall be provided with a steam whistle or other efficient steam-sound signal, so placed that the sound may not be intercepted by any obstructions, and with an efficient fog-horn to be sounded by a bellows or other mechanical means and also with an efficient bell. (In all cases where the regulations require a bell to be used, a drum will be substituted on board Turkish vessels.) A sailing ship shall be provided with a similar fog-horn and bell. In fog, mist, or falling snow, whether by night or day, the signals described shall be used as follows:—(*a*) A steamship under way shall make with her steam whistle, or other steam sound signal, at intervals of not more than two minutes, a prolonged blast; (*b*) a sailing ship under way shall make with her fog-horn, at intervals of not more than two minutes, when on the starboard tack, one blast, when on the port tack two blasts in succession, and when with the wind abaft the beam three blasts in succession; (*c*) a steamship and a sailing ship, when not under way, shall, at intervals of not more than two minutes, ring the bell.

Every ship, whether a sailing or a steam ship, shall, in a fog, mist, or falling snow, go at a moderate speed.

When two sailing ships are approaching one another so as to involve risk of collision, one of them shall keep out of the way of the other as follows:—(*a*) A ship which is running free shall keep out of the way of a ship which is close hauled; (*b*) a ship which is close hauled on the port tack shall keep out of the way of a ship which is close hauled on the starboard tack; (*c*) when both are running free with the wind on different sides, the ship which has the wind on the port side shall keep out of the way of the other; (*d*) when both are running free with the wind on the same side, the ship which is to windward shall keep out of the way of the ship which is leeward; (*e*) a ship which has the wind aft shall keep out of the way of the other ship.

If two ships under steam are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other. This rule only applies to cases in which each ship sees the masts of the other in a line, or nearly in a line, with her own, and by night to cases in which each ship is in such a position as to see both the side lights of the other.

If two ships under steam are crossing, so as to involve a risk of collision, the ship which has the other on her own starboard side shall keep out of the way of the other.

If two ships, one of which is a sailing ship and the other a steamship, are proceeding in such direction as to involve risk, the steamship shall keep out of the way.

In taking any course authorised or required by these regulations, a steamship under way may indicate that course to any other ship by signals on her steam whistle. One short blast to mean, "I am directing my course to starboard." Two short blasts, "I am directing my course to port." Three short blasts, "I am going full speed astern." The use of these signals is optional.

In narrow channels every steamship shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such ship.

Nothing in these rules shall exonerate any ship, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper look-out, or of the neglect of any precaution which may be required by the ordinary practice of seamen or by the special circumstances of the case.

Nothing in the rules shall interfere with the operation of a special rule duly made by local authority relative to the navigation of any harbour, river, or inland navigation. Nothing shall either interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights or for two or more ships of war or for ships sailing under convoy.

When a ship is under distress and requires assistance, the following shall be the signals to be used either together or separately. In the daytime—(1) a gun to be fired at intervals of about a minute; (2) the international code signal of distress indicated by N.C.; (3) the distance signal consisting of a square flag having either above or below it a ball or anything resembling a ball. At night—(1) a gun fired at intervals of about a minute; (2) flames on the ship (as from a burning tar barrel, oil barrel, &c.); (3) rockets or shells throwing stars of any colour or description, fire one at a time at short intervals.

THE INSTITUTION OF CIVIL ENGINEERS.

UNDER the presidency of Sir Frederick J. Bramwell, F.R.S., the First Ordinary Meeting of the Session 1885-86 was held on Tuesday, the 10th of November.

The Paper read was on "Experiments on the Steam-Engine Indicator," by Mr. Arthur William Brightmore, B.Sc., Stud. Inst. C.E.

The author commenced by briefly indicating the object of the Paper, viz.: an examination into the number and effects of the errors of the Steam-engine Indicator. In the first place a short account was given of the indicator, engine, reducing mechanism, friction-brake and speed-indicator employed in the experiments. Then the results and method of carrying out a series of experiments on the deflection of indicator-springs, under given weights, at the ordinary temperature and at the temperature of boiling-water were set forth. Next, experiments were recorded which had been made to investigate the effect of the inertia of the moving parts on the diagram before the speed was sufficiently high to cause oscillations to be sensibly present. In the cases examined the effect was shown to be very small. Following, was a formula, based on the theory of the indicator, for the number of oscillations of a spring per minute. The number of oscillations as found from a series of diagrams was compared with the number as calculated from the above formula. Several methods by which these oscillations might be reduced, together with the inaccuracies which might be consequently introduced, were commented upon. Lastly, the marked effect upon the diagram of the stretching of the indicator-cord, from the changing forces acting upon it, was noted. These forces were due to the inertia and friction of the drum and to the tension of the drum-spring. The electrical apparatus, by which the amount of the distortion and shortening of a diagram due to this cause were ascertained, was described.

The discussion upon the above Paper was taken in conjunction with that "On the Theory of the Indicator, and the Errors in Indicator-Diagrams," by Professor Osborne Reynolds, M.A., LL.D., F.R.S., M. Inst. C.E., which was read at the last Meeting of the Session 1884-85, and of which a full abstract is repeated, as under:—

The object of this Paper was to define the causes and extent of the disturbances in indicator-diagrams. The theory, as given, had been taught for several years in Owen's College; but the publication had been deferred to enable an extensive series of experiments to be made. These experiments had now been carried out by Mr. A. W. Brightmore, late Berkeley Fellow in Owen's College, Manchester. In the first place it was shown that there were five principal causes of disturbance, namely, the inertia of the piston of the indicator and its attached weights; the friction of the pencil on the paper, and its attached mechanism; varying action of the spring; inertia of the drum; friction of the drum.

The effect of the inertia of the pencil and its attached mechanism presented a mathematical problem, by the solution of which it was shown that there were two disturbances from this cause; one, a general enlargement of the mean indicated pressure, depending on the weight of the moving parts of the indicator, the stiffness of the spring and the square of the speed. The other disturbance was a vibration of the pencil. Every indicator-piston vibrated when disturbed, so that the period of vibration depended on the stiffness of the spring.

The error which these oscillations caused in the area of the diagram depended on their magnitude, and, to a greater extent, on the smallness of the number in a revolution. But the evil of these oscillations was not so much an effect on the area, as in the disfigurement and the confusion they produced in the diagram. So long as there were 30 of these oscillations in a cycle, the

necessary fluid friction of the indicator-piston would so far reduce them as to render a fair diagram possible, but when the number was as low as 10 it was all the pencil could do to prevent them upsetting the diagram.

The friction arising from the pressure of the pencil always acted to oppose the motion of the pencil, and therefore rendered it too large during expansion and exhaust, and too small during compression and admission, and thus the general effect was to increase the size of the diagram. This friction consisted of that of the pencil on the paper; and that of the mechanism, caused by sustaining the pressure of the pencil. The effect of the friction of the pencil was greatly reduced by the motion of the paper. The magnitude of these effects taken together on the area of the diagram depended on the construction of the instrument and on pencil-pressure. From numerous experiments it would appear possible to make a difference of as much as 5 per cent. in a locomotive in mid-gear by pencil-friction.

The conclusions, as regarded the motion of the pencil were that the general effect of inertia and friction were both to increase the size of the diagram; that so long as the speeds were such that the number of vibrations of the pencil during a revolution of the engines was not greater than 15, the effect of inertia was less than 1 per cent., but that if the number was greater than 30, oscillations would show themselves unless the pencil-friction was increased. They might, by this, be kept down till the number of vibrations was equal to 15, but not farther, and then the necessary friction would effect the area of the diagram about 5 per cent. For the diagrams to be sensibly accurate, and free from oscillation, the speed must not be greater than would make the number of vibrations equal to 30. These speeds were given in the paper for Richards' indicators.

The effect of the inertia of the drum with an elastic cord was shown to be a nearly uniform elongation of the diagram. The result of the varying stiffness of the drum spring was a nearly uniform contraction. With Richards' indicator these two latter disturbances nutralised each other at a speed of 150 revolutions per minute. At other speeds the effects were apparent in the length of the diagram; but except when the expansion was great and the connecting rod short, they did not affect the indicated pressure. The friction of the drum with an elastic cord caused the cord to be longer during the forward stroke than during the backward stroke, so that the diagram was distorted and shortened, the drum being uniformly behind its proper position during the forward stroke, and before its position during the backward stroke. This distortion diminished the area of the diagram according to the rate of expansion and the length and elasticity of the cord used. This was definitely expressed by a formula. This disturbance, the influence of which was very great in cases of high expansion, large engines, and ordinary cords, appeared to have been unnoticed. The circumstances on which it depended were the elasticity of the cord and the friction of the drum, and the question was how far these existed in the ordinary indicators. It might be said that the diagrams which led to the discovery of this effect were taken with an indicator which had been in constant use for several years. It was in apparently perfect condition, and the diagrams did not differ essentially from those which had been previously taken. The cord was one which had been supplied by the maker. The manner of the discovery was described: For years the author had pursued in the class the method of testing the vibrations of the indicator-pencil by projecting them on to the crank-circle, and he had noticed that the first oscillation fell short, and shorter in the back diagram than in the front. The cause of this was not obvious, and it was partly with a view to determine this cause that Mr. Brightmore's investigation was commenced. A slight error in the reducing rod, which had a fixed centre and a slot in which a stud in the slide-block worked, was altered. This, however, did not get rid of the effect. A new cord was substituted for the old one, and the effect was found to be much enhanced, the new cord being more elastic than the old one. This reduced it to the stretching of the cord, but it was only after carefully working out the effect of the inertia of the drum, and it was seen this was to lengthen the first oscillation at the back end that the friction was examined. The indicator was taken to pieces, cleaned and oiled; then the effect was much reduced. Several new wires and cords were used, and eventually steel wire was adopted as the best. The test supplied by the oscillations could only be applied to diagrams taken at high speeds, and the test furnished by the influence upon area was vague. What was wanted was an independent means of determining the simultaneous positions of the drum and the engine-piston. As the best method of meeting this, it was decided to arrange an electric circuit through the pencil to the drum with sufficient electromotive force to prick the paper, making the engine-piston close this circuit at eleven definite equidistant points in the motion backwards and forwards. This was successfully carried out, and the stretching of the cord during the backward and forward strokes was definitely ascertained. Taking the smallest results obtained with a cord, it appeared from these experiments that the least difference of stretching was to make this difference, in inches, 5 per cent. of the length of the cord in feet. Examples of this effect in diminishing the mean indicated pressure were given. Thus, in a locomotive cutting off at one-quarter it was 8 per cent.; in a condensing engine having 3·5 feet stroke, cutting off at one-tenth, 20 per cent.; and the same compounded, 10 per cent.

These would seem to be the smallest results that could have occurred in ordinary practice. The conclusion, however, that hitherto the normal I.H.P. from engines had been from 10 to 20 per cent. too small must wait for verification. Yet there were not wanting independent evidences of such an effect. In diagrams taken from engines at high speeds the admission line would not but for this effect be vertical. It would show a certain amount of detail, and the first oscillation would not have a sharp top. Moreover, it was commonly found that the expansion line, allowing for clearance, was above the true expansion line for the steam. This apparent rise in the curve of expansion was exactly what would result if the apparent cut-off was too early, and this was the result of the effect that had been considered. The author had tried several diagrams, and found that after correction the expansion line came out very close to the true curve.

In making these comparisons the explanation of another feature of diagrams became apparent. When the two diagrams were traced on the same card, there was sometimes a want of symmetry about them, and in this case the cut-off was shorter on the back than on the front diagram. This the author attributed to the friction of the drum when the cord for the back diagram was longer than that for the front. When this was the case the relative lengths of the cord were about 1 to 1·8. These observations were illustrated in a diagram from "Richards' Indicator." To test this diagram a tracing was taken, and reversed so that the front diagram was superimposed on the back. It was observed that the diagrams were of different lengths, and the difference was about the same as the difference in cut-off; that notwithstanding the apparent cut-off in the back diagram was to that in the front in the ratio of 2 to 3, the expansion line of the back diagram was the same shape as that in the front, and that if the diagrams were restored, supposing the lengths of the cords used to have been 5 ft. and 9 ft., the diagrams became exactly similar, and, allowing 2 per cent. clearance, the expansion line came to be the true expansion line for that cut-off. The mean pressure was 14 per cent. larger than from the original diagram.

Such instances as these seemed to sufficiently establish a case against the blind faith which appeared to be at present placed in the accuracy of the indicator diagrams. But, in conclusion, the author stated that he should be very disappointed if anything in this investigation should have the effect of diminishing reliance on the indicator itself. He would have the instrument treated fairly, and instead of being the object of unthinking worship he would have it the object of careful study and experimental investigation, so that the limits of its wonderful perfection might be known exactly, and that reliance placed on it which sprang from knowledge.

Admiralty Reform.—The principal appointment, the post of Director of Dockyards, has been offered to Professor Elgar, LL.D., of Glasgow University.

Messrs. Edward Withy & Co., Hartlepool, have recently been added to the Admiralty list of firms who may be invited to tender for iron or steel unarmoured vessels.

Important Shipbuilding Contract.—Messrs. Caird & Co., Greenock, have just contracted to build for the Indian Government a large troopship, a five-decker of about 5,000 tons. She is to be built of steel, and is to be supplied with triple expansion engines of 1,500 I.H.P.

Russian Shipbuilding.—To encourage Russian shipbuilding, the authorities at St. Petersburg are said to have under consideration a scheme for imposing Customs duties on vessels built abroad to the order of Russian subjects. Iron vessels of 500 tons and under will pay on entering a Russian port ten roubles per ton, and above 500 tons five roubles per ton; vessels built of iron and wood will pay four roubles per ton.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—Amalgamation is now the order of the day among the larger firms connected with the shipbuilding and engineering industries, and as the truth of the motto "union is strength" has been amply demonstrated in other phases of industrial life, there seems no reason why it should not bear a correct application to such cases as those now referred to. A short time since the shipbuilding firm of Messrs. A. Leslie & Co. became amalgamated with the engineering firm of Messrs. R. & W. Hawthorn & Co., and great results in the way of stimulated business are expected to be brought about by the combination. Two other important firms in the same lines of business (namely, Messrs. H. McIntyre & Co., shipbuilders, and Messrs. R. Stephenson & Co., engineers) have during the present month entered into similar arrangements of partnership or amalgamation, and in this case also results of a most beneficial character are expected to follow. Messrs. McIntyre's establishment has only been in operation about two years, having been started in 1882 and closed in 1884, but its facilities for cheap and rapid production are unique, and under efficient management it cannot fail to be a succesful concern when times improve. Messrs. R. Stephenson & Co. is, as is well known, one of the oldest engineering firms in the country, and has a high repute for both marine and locomotive work. It is understood that owing to the arrangement just mentioned the marine department will be removed from South Street, Newcastle, where it is at present located, to Hebburn, where Messrs. McIntyre's yard is situated. Messrs. Armstrong, Mitchell & Co. have been commissioned to build two more cruisers for the Japanese Government, and frame-turning for these has been commenced. It is understood that the firm are in negotiation with the Chinese Government with reference to some important contracts that are to be given out. Although there is plenty of work in the yard, the firm proposed the introduction of three-quarter time during the winter months; the proposal met with little favour from the workmen, however, and owing to their remonstrances it was withdrawn. The yard belonging to the firm at Low Walker is almost at a standstill, and will soon have to be closed unless some orders are obtained. Messrs. C. M. Palmer & Co. have, it is stated, obtained an order for three large steamers from the Austrian Lloyd's. Their yard at Jarrow is at present pretty busy, and their new steel works at the same place are very nearly ready for the commencement of operations. Messrs. Hawthorn, Leslie & Co. have received an order from Her Majesty's Government for twelve torpedo boats 30 ft. long by 11 ft. beam, to be built of mahogany. Each of the boats will be fitted with a small deck-house, 8 ft. long by 5 ft. wide. There is an appearance of improvement at Messrs. Swan & Hunter's yard, Wallsend, where a couple of vessels that have been standing on the stocks in an uncompleted state for many months, are now to be finished off. Messrs. W. Dobson & Co., of Low Walker, are framing a vessel of average size, and they have obtained an order for four smaller ones, which, it is stated, will be proceeded with at once. Messrs. W. Richardson & Co. and the Tyne Shipbuilding Company have each a couple of vessels on the stocks, and Messrs. Readhead have one vessel in progress. In marine engineering, Messrs. Palmer's Works, Jarrow, are still the busiest; but at the Wallsend (Slipway) Engine Works there is a good deal of work in hand. Some heavy castings for marine work have been received at the Neptune Engine Works, Low Walker, and work for fitters, turners, &c., will now be more plentiful at that establishment. Messrs. Hawks, Crawshaw and Sons' rolling mills, Gateshead, have been working intermittently during the month. The second (and last) span of a steel bridge which that firm are constructing for India, is nearly completed, and all other departments are now very slack. Messrs. John Abbott & Co.'s works in the same locality are keeping well employed, especially the department for the production of large metal pipes, the demand for which is now very good. The chain-making trade is still extremely depressed, there being scarcely anything to do for the operatives.

The Wear.—The most important incident that has occurred in connection with the Wear shipbuilding trade during the month, is the acceptance of an order by Messrs. Boolds & Sharer for an iron steamer of over 3,000 tons burden. The order, which is from a Liverpool firm, has been booked at perhaps the lowest price on record, and the builders do not expect to be able to make the contract pay. They will, however, avoid the necessity of closing the yard and breaking up their staff, and the connection with a great shipping port which is likely to be obtained through the successful completion of this order will no doubt prove of value to them. The keel for the vessel has already been received, and frame turning will be commenced in the first week of December. This is the only order that has been booked on the Wear lately, and all the yards, with the exception of Messrs. J. L. Thompson and Sons and Messrs. Short Brothers, are now in the last stage of slackness. The latter firm are plating a vessel of large size and preparing another for launching, and the former are plating two while three others are in various stages of forwardness. A Conciliation Board for the settlement of trade disputes in the Wear ship-building industry has at last been definitely established, and it is expected that great good will result to the port therefrom. The sections of operatives who have joined the Board, are the joiners, smiths, shipwrights, and drillers. The members of the Boiler Makers' and Iron Shipbuilders' Society have declined to attach themselves to the new institution, their plea being that as they have in each district a paid official, whose sole duty is the settlement of disputes with the employers, there is no need for the machinery of a conciliation board in their case. An intimation has been conveyed to the officials of this society, that a reduction of wages is necessary, and will shortly be demanded. The employers have had two meetings to consider the subject, but they have not yet agreed upon the amount of reduction to be asked for, or the date for issuing the notice. In the marine engine trade business is slightly improved, most of the establishments having obtained some repairing work to do in addition to the new work in their shops. Of the smaller engine works, Mr. John Lynn's, at Pallion, is one of the busiest, steam winches and "cargo whips" being the special articles of production. An order from Liverpool for metal columns has kept the Portobello Foundry moderately busy for some time, and some of the other foundries have a little more work than was to be noticed in them last month. There is only one forge out of seven working in the district. The local rolling mills have done a little better this month than last. Local shipments have been exceptionally heavy during the month, nearly 100,000 tons having been shipped to London alone. Shipments of coke and patent fuel have also been satisfactory, and the demand for the latter on home account is steadily increasing.

Hartlepool and the Tees.—Shipbuilding at the Hartlepools is still dull, but on the Tees a decided improvement is to be noted. As stated last month, Messrs. Dixon, of Middlesbro', and Messrs. Richardson & Duck, of Stockton, have their stocks pretty fully occupied, and now the announcement is made that Messrs. Pearce & Co., of the latter place, have secured an order for a vessel to be nearly 400 ft. long. The marine engineering establishments in the district are better off for work than those on the Tyne and Wear. Forty puddling furnaces have been re-started at the Britannia Ironworks, Middlesbro', and it is stated that it is the intention of the owners (Messrs. Dorman, Long & Co.) to commence at once the manufacture of iron girders. Messrs. Raylton Dixon & Co., of the Cleveland Dockyard, Middlesbrough, have received an order for the construction of an iron steamship of 2,000 tons burthen for a Liverpool firm. This new order will keep the firm going throughout the winter.

Institution of Engineers and Shipbuilders in Scotland.—The opening meeting of the new session of this Institution was held last month, Professor James Thompson, F.R.S., President, in the chair. Having formally opened the meeting, the President proceeded with the presentation of awards voted last session on account of papers read in the session 1883-84. They were—the Institution medal, to Mr. Ralph Moore, one of her Majesty's Inspectors of Mines, for his paper on "Cable Tramways"; the Marine Engineering Medal, to Mr. J. H. Biles, Clydebank Shipyard, for his paper on "The Stability of Ships at Launching;" a premium of books to Mr. Robert L. Weighton, M.A. (Messrs. Hawthorns, Newcastle-on-Tyne), for his paper on "The Compound Engine Viewed in its Economical Aspects;" and to Messrs. Purvis and Kindermann (Leven Shipyard, Dumbarton), also a premium and books for their paper on "Approximations to Curves of Stability from Data for Known Ships." A short introductory address was then delivered by the President, who dealt chiefly with the desirability of force tests being more frequently applied to engineering and other constructional works. Mr. Staveley Taylor's paper, read last session, on "The Butt Fastenings of Iron Vessels," was submitted for discussion, the speakers being Messrs. Biles, A. C. Kirk, and Henry Napier. An exceedingly interesting paper on "The Great Caissons of the Forth Bridge," by Mr. Andrew S. Biggart, C.E., was afterwards read, and the discussion upon it was postponed till the next monthly meeting. One new member and six new graduates were elected.

NOTES ON SHIPBUILDING.*

By Mr. J. H. Biles (of Messrs. J. & G. Thomson), Clydebank, Glasgow.

(Concluded from page 216.)

There is one point which I would respectfully suggest to Lloyd's that they should do in order to be quite equal in their treatment of iron and steel. It is that as they insist on a breaking strain of 28 to 32 per square inch on a reduction of 20 per cent. in the thickness in passing from iron to steel, they should insist on iron passing exactly similar tests, but with the limits of strength reduced in exactly the same proportion as the thickness of steel has been reduced. For instance, if an iron ship has plating $\frac{12}{16}$ in. thick, and a corresponding steel one has plating $\frac{12}{20}$ in. thick, the $\frac{12}{20}$ plating per inch of breadth is expected to stand between $\frac{12}{20}$ of 28 and $\frac{12}{20}$ of 32 tons, or between $16\frac{4}{5}$ and $19\frac{1}{5}$ tons. Why should not the iron plating per inch of breadth be expected to stand between $16\frac{4}{5}$ and $19\frac{1}{5}$ tons per inch of breadth? It has to do the same work. If this were insisted on, the iron would have to possess a tensile strength of between $\frac{16\frac{4}{5}}{\frac{12}{16}}$ and $\frac{19\frac{1}{5}}{\frac{12}{16}}$, or $22\frac{2}{5}$ and $25\frac{3}{5}$ tons per square inch of sectional area.

Some minor improvements in shipbuilding which are due to the use of steel may be briefly noticed. In a paddle-boat which we are building, there are no reverse bars on the floors, but the floor-plates are flanged. This saves one leaf of an angle and all the rivets which connect the reverse bar to the floors. This flanging is extensively adopted at Clydebank instead of plates and angles for all bracket work and intercostal work, and for bulkhead plates, where the flanging of the plates takes the place of an angle stiffening, and various other purposes. For thin plates the flanging is done cold, but for plates above $\frac{3}{8}$ in. it is done hot.

Z frames have been extensively used in the framing of the *Scout*. We have found that for almost all the frames of a ship these Z's, when of the same depth and thickness as the frame, are cheaper than the ordinary method of frame and reverse.

It was my intention to have noticed some modifications in the system of construction which appear to me to be desirable in a ship built of steel, but time has not permitted it.

One point may be worth noticing. In the National steamship *America*, all the steel contributing to longitudinal strength above the lower deck, which is practically at the neutral axis, was made of a tensile strength of from 32 to 36 tons. All below was from 27 to 31 tons.

Discussion.

The President said with regard to Mr. Bile's paper they would all admit that there was no reason for any apology by its author. It contained matter not only of the highest importance in a national point of view, but especially in a local point of view. He would therefore call upon the members to support the vote of thanks which he now proposed to Mr. Biles for his most interesting and valuable communication.

Mr. J. Hamilton said that his firm had had an equally large experience in the use of steel with the firm that Mr. Biles represented, and he thought he might say with practically the same results. His calculations corroborated nearly all the figures that Mr. Biles had put before them as to the relative cost values of iron and steel ships. Iron had been a very good friend to them, but he thought they had arrived at a point when for any structure where the superior strength of steel could be made use of it was of advantage to use it in preference to iron. If that was true with regard to bridges, it was very much more true for ships, where any unnecessary weight to be carried was an incubus. Mr. Biles referred to Lloyd's increasing the thickness of the butt straps, which in a large ship of 4,000 tons increased the cost by about £100, and suggested that the butt straps would do as well if made of iron instead of steel. He (Mr. Hamilton) thought there were very few members who would like to introduce iron butt straps into a steel structure. He had no sympathy with the idea that steel butt straps were destroyed in the punching; at any rate what they had to do with were rivetted up butt straps, and the results of experiments had shown that the strength of the rivetted up joint was as strong when it broke through the rivets as it was in the solid plate. Though he had no sympathy with that idea, he still believed that the butt straps should be made as strong as Lloyd's had made it, and he would rather see butt straps in iron ships brought up to the same strength as butt straps in steel ships.

Mr. Windson Richards said he was not a shipbuilder, but it struck him that this paper by Mr. Biles was a very excellent one. From a manufacturers' point of view it had one satisfactory feature, and that was that it was the first paper which had been read before the Iron and Steel Institute by a shipbuilder which did not ask for a reduced price of plates. Mr. Biles said it would be very desirable to have larger plates. He would like Mr. Biles to give them an idea as to how large those plates should be to be handled in a shipyard, for there would be no difficulty in supplying him with plates 50 or 60 feet long by 5 feet wide or even longer. He should be glad if shipbuilders would let them know the largest sized plates they could deal with.

Mr. Martell (Lloyd's) expressed his gratitude to Mr. Biles for his paper, which was a very valuable one to shipbuilders and shipowners. Mr. Biles had referred to a paper which he (Mr. Martell) had read seven years ago before the Institution of Naval Architects, pointing out the saving to shipowners by the adoption of steel instead of iron, and Mr. Biles's results were not very different from those which he (Mr. Martell) was enabled to put before the public at that time. He might mention that his data had been obtained to a very great extent on the Clyde, because it was only there at the time that ships were being built to any great extent. He desired to express his gratification that at a time when no one knew much about steel as employed for shipbuilding, the committee of Lloyd's took upon themselves the responsibility of sanctioning its adoption by individual shipbuilders and shipowners. Though he had been charged by some of his friends with being somewhat of an obstructionist against steel, he had from that time always expressed his opinion as to the value of the material, and he thought it would soon generally supersede iron. Having said so much, he should like to add a word on behalf of their old friend iron. It should be borne in mind that they had millions of tons of shipping at present, having the highest class, doing the work assigned to them efficiently in all respects, and not breaking to pieces, as some persons who had had little or no experience might lead them to believe. If they condemned the material of which those ships were made, they really condemned vessels that were doing their work in a perfectly satisfactory manner. At the same time he should be glad to see steel superseding iron, because steel was a tested material, and they knew precisely what every piece of it was capable of doing. Its manufacture had reached that point of certainty that all whom he knew who had used it for building ships had stated that they never wanted to build another iron ship. The great object had been to get the greatest amount of efficiency out of the least amount of material. As had been pointed out, a greater amount of cargo could be carried with a ship made of a material stronger than iron, and, in the next place, it would be a benefit to the owner. But, as Mr. Biles had very properly pointed out, there were two questions occupying the minds of shipowners which prevented them going in generally for the adoption of steel instead of iron. It had been stated that steel ships were so soft that when they came alongside wharves or tenders they bent like a piece of india-rubber, and that deterioration went on very rapidly, and a steel ship would not last nearly as long as an iron ship. Those statements were put forward so strongly some time ago that they caused a sort of scare amongst underwriters, and he was requested by the committee at Lloyd's to investigate the subject thoroughly, so that they might know where they stood. He accordingly made a very exhaustive enquiry; he obtained all the information he possibly could from the surveyors at all the out-ports; he looked up all his own data in reference to the large number of steel ships that he had inspected for some years past after they had come home and performed very heavy work in carrying very heavy dead-weight cargoes, and he would go to the extent of saying that he could find no instance where it could be clearly proved that a steel ship had failed for want of general structural strength. Some of them appeared to show sometimes a strain locally, but that was entirely the fault of the construction in some way or other, in consequence of omissions, little oversights, where the continuity and strength had not been kept up, where something was not supplied in order to make that continuous strength perfect. That was the extent of his experience, down to the present time, in regard to the efficiency of steel ships and their ability to do the work required of them. With regard to deterioration, it could not be too generally known that where the black oxide was not taken off before coating, a galvanic effect was set up between the scale and the body of the iron, and serious effects occurred, producing a rapid deterioration. Exhaustive tests had been made to demonstrate that fact, and the great advantage of clearing the scale off before coating had been

* *Paper read before the Iron and Steel Institute, at Glasgow.*

proved. It could not be too clearly understood that it was most important that the ship should be allowed to rust, so that the whole of it could be cleared off before the ship was painted. Steel was so rapidly succeeding iron, that they ought not to try to force it on and coerce any other industry. Iron had answered, and was answering its purpose. It had been used for a number of years for shipbuilding of the highest class, and they ought not now to organise a body of surveyors to go into all the ironworks throughout the country and tell them to give it up. That would be a gigantic undertaking, and his committee would certainly refuse to go to that extent. If it were essential they would endeavour to do it, but practically he did not think it was. He was convinced from experiments that Lloyd's had made, that all the iron used for shipbuilding purposes would be found to stand from 18 to 20 tons per square inch tensile strength, and with the present scantlings he thought that was sufficient. Without going to the extent suggested by Mr. Biles, he believed that steel would supersede iron very quickly, and he hoped to see the day when the ironworks would be formed into steelworks, and all ships would be built of that magnificent mild steel which had answered its purpose so thoroughly.

Mr. Biles in reply thanked the members for the kind reception given to his paper. With regard to the plan of making the butt straps of a steel ship of iron, Mr. Hamilton had said that he would prefer to make them in an iron ship up to the strength of those in a steel ship, but if the butts of an iron ship were already found to be strong enough (as Mr. Martell would no doubt admit), the butts of a steel ship must be a little in excess of the requirements, and if Mr. Hamilton would reconsider the matter he would probably rather go in the direction of reducing the strength of the butts of a steel ship, and the way to do that would be to make them of iron. However, that was a matter to be dealt with from the point of view of mechanical production rather than of absolute efficiency. No doubt iron butt straps put into a steel ship would answer most of the purposes, but those who were anxious to be quite safe would probably adhere to the practice of steel butt straps. With regard to the maximum size at which plates could be produced, he might say that they had used very light plates $\frac{5}{16}$ and $\frac{1}{4}$, 16 ft. long and 5 ft. wide, which he thought represented the maximum required. Those plates were used on a very small ship where there was a large amount of curvature, and a very rapid change of curvature. If shipbuilders were to alter their plans there would not, he thought, be much more difficulty in producing plates half as large again, namely, 24 ft. by 7 ft. 6 in., because the differences of curvature in a plate of that size were not more for a big ship than in the size he had given for a small ship. For all flat surfaces, such as dock plating, it appeared to him that the only limit was that of the gap in the punching machines and also of the amount of lifting appliance in the ship. Those could easily be supplemented, for on ordinary ship work they had at present gaps up to 36 in., so that they could use plates 6 ft. wide. Even if the gaps were not big enough for a plate 7 ft. wide, there was only a small amount left in the middle to be drilled or treated in some other way, and the extra cost of that would be far more than met by the reduced amount of riveting that would be put into the ship. With reference to the effect of riveting on high tensile steels, he knew one instance where high tension steel had been used from 32 to 36 tons. In all the plating of the *America* above the lower deck, the steel had ranged from 32 to 36 tons. There was a great deal of riveting in it, and no complaints had been made. Further than that, while she was lying in the dock at Glasgow a small vessel came into collision with her by sticking the end of its bowsprit into her side. Some of the beams in the neighbourhood were cracked through, but the outside plating in the way of riveting showed no sign of cracking at all, as far as he remembered. It appeared to him that in regard to iron ships, Lloyd's had generally had rather an excess of keelsons, which had been put in for the sake of longitudinal strength. If they were not so heavy, but more numerous, it would be a better combination.

John Elder and Co.—The firm of John Elder & Company, Glasgow, is registered as a limited liability company, under the name of the Fairfield Engineering and Shipbuilding Company. The deed of association sets forth that the company is formed to build, equip, and repair vessels of all kinds, steam engines, boilers, and machinery, and also to manufacture guns, torpedo boats, torpedoes, and other war instruments and appliances of every kind. It is believed that a new development of the well-known works in the direction of manufacturing ordnance is contemplated.

CLYDE INDUSTRIAL NOTES.

INDICATIONS OF A REVIVAL IN SHIPBUILDING.

The cloud of intense depression under which the shipbuilding, engineering and cognate industries of the Clyde have so long rested, gives indication at last of lifting somewhat—let us hope of breaking up and completely disappearing in the near future. All the shipbuilding districts on the river, and especially Partick, Govan, and Dumbarton, have suffered intensely from the dearth of work. The roll of unemployed has been for long a large one, and until a few days ago was being constantly added to, while the outlook was of the blackest description. Hundreds in the districts named have been on the verge of starvation, and but for the generous and comprehensive schemes of relief organised by the benevolent in these localities very many must have succumbed. In order to make what little work there was on hand last as long as possible and afford employment to as many hands as possible, many of the shipyards reduced the working hours by one-fourth and even one-third from what is usual. Several yards have for a time been practically closed, only the official staff—reduced however—and a few foremen and workmen being retained. Amongst these were Messrs. Aitkin & Mansell; The Govan Shipbuilding Company, and Messrs. D. & W. Henderson, Meadowside, Partick; Messrs. Birrell, Stenhouse & Co., Dumbarton; and of the yards working on restricted time—Messrs. A. & J. Inglis, Pointhouse; The London & Glasgow Shipbuilding Company, Limited; Messrs. Alex. Stephen & Sons, Linthouse; and Messrs. William Denny Brothers, Dumbarton.

While, from the intelligence of orders received within the past few days (we write on November 24th) we are scarcely warranted in adopting the past tense in speaking of the troubles of *all* the Clyde yards, still the cheering beams of returning sunshine have now penetrated the dense cloud for not a few of them. From the foregoing remarks about scarcity of work we exempt of course to a considerable extent the yards from which Government work was recently ordered, which work at the time it was secured came as a "boon and a blessing" to some of the foremost of Clyde firms and to hundreds if not thousands of workmen's homes. The orders, which were duly noticed in our columns at the time, are now being actively carried out in the respective yards—Messrs. R. Napier & Sons, Govan; Caird & Co., Greenock; and J. & G. Thomson, Clydebank. The latter firm has within the past few days secured an order for a warship of somewhat noteworthy description. This is a swift and strong cruiser of distinctive design, for the Spanish Government, embodying the ideas of Admiral Perzuela, Minister of Marine, who is of opinion that a vessel can be built of large size so as to keep the sea in all weathers and at the same time have all the advantages of high speed possessed by a torpedo-boat of the ordinary description but with much increased offensive powers. The design by Messrs. Thomson, embodying the Spanish Minister's idea, which we may say was selected as the best of several submitted to the Spanish Government, shows a boat capable of acting as a torpedo destroyer, carrying seven guns and six torpedoes, and steaming at the very high rate of 26 miles per hour.

Messrs. Elder & Co., whose gigantic Works for a considerable time were well nigh destitute of work, have now their hands full. In addition to the three large steamships for the North German Lloyd's Company, for whom they have built so extensively, and the three paddle steamers of 1,700 tons each for the Queensland and Flushing day service of the Zeeland Company, Netherlands, the firm have recently contracted for a vessel of 4,000 tons. Fairfield Works have now close upon 25,000 tons on hand, all of which consisting of steam tonnage must thus give employment to its ordinary vast army of engineering as well as shipbuilding operatives. An important change and extension in this firm's constitution and operations has just been arranged. This change has been registered under the designation of "The Fairfield Shipbuilding and Engineering Company, Limited," and a new development of its works in the direction of producing ordnance is contemplated. The deed of association sets forth that the Company is formed "to build, equip, and repair vessels of all kinds, steam engines, boilers, and machinery; and also to manufacture guns, torpedo-boats, torpedoes, and other war instruments and appliances of every kind and description."

In the same district as Fairfield, several firms who have been almost destitute of work for some time have very recently been entrusted with orders. Messrs. Alex. Stephen & Sons have booked an order to build a steel screw steamer of 3,000 tons for the Clan Line, having triple expansion engines; and it is understood they

have secured other work, definite particulars of which have not transpired. A similar remark applies to the London and Glasgow Company, and Messrs. D. & W. Henderson have just been empowered to construct a large steam yacht of steel. This vessel, which is from the designs of Mr. G. L. Watson, is to be 160 ft. by 24 ft. by 15 ft. 8 in., and is to attain a fast speed, and with this in view she is to be fitted with triple expansion engines of the most modern type.

Much gratification prevails at Greenock through the announcement recently made that Messrs. Scott & Co., of that town, which has been feeling the depression acutely, have secured an order for no fewer than five steamers of 2,600 tons each, for the China Steam Navigation Company, Limited. These steamers, which have been negotiated for in this country by Messrs. John Swire and Sons, of London, will be fitted with triple expansion engines, having all the most recent improvements and of large power, capable of driving the vessels at a high rate of speed for mail purposes. It may be stated that within the last ten years Messrs. Scott & Co. have built for this Company no fewer than twenty steamers. Messrs. Rankin & Blackmore, engineers, Greenock, have received from Messrs. Wyllie & Co. an order to supply them with a very large and powerful tug steamer, with engines of 1,500 H.P., for the Clive Steam Tug Company of Calcutta, similar to the *Clive* built for the same Company last year. The hull will be let out for construction to Messrs. R. Duncan & Co., Port Glasgow. The dimensions of the new vessel are:—Length, 192 ft.; breadth, 30 ft.; and depth, 14 ft., and Messrs. Rankin and Blackmore will supply her with machinery. For the steam yacht building at the Culzean Shipbuilding Yard, for Provost Clark, of Paisley, Messrs. Kincaid & Co., engineers, Greenock, have secured the contract to supply engines of the triple-expansion type.

Dumbarton has suffered more acutely from the present depression than at any time during the past quarter of a century. Great destitution exists, but the scheme of relief organized by sympathetic townspeople and carried out by the Benevolent Society achieves a world of good. In this district too, however, cheering intimation has been made of orders received. One yard—Messrs. Birrell, Stenhouse & Co.'s—which has been closed for some time, opens again with work sufficient to employ a considerable number of hands. Messrs. A. M'Millan & Son have recently contracted for as many as four vessels, and it is confidently hoped that more orders will follow. Of the four vessels ordered, one is a steamer of approaching 2,000 tons, and three are sailing vessels—one of which is of the largest tonnage now being built, *i.e.*, about 2,450 tons, and rigged with four masts. Messrs. M'Millan over a year ago purchased the shipyard and stock belonging to Messrs. Henry Murray & Co., who failed, and it is thought sufficient work may be obtained to justify them resuming operations in that yard.

Messrs. Denny & Brothers, of Leven Shipyard, who during almost every former period of dulness were kept busy by their special customers, are at present unfortunately circumstanced as to work. Only one vessel is on the stocks, and she is being constructed on "spec." She is the largest vessel yet built in Leven Shipyard. Messrs. Denny have been dispensing with the services of a large portion of their highly trained scientific staff The shipyard of Messrs. Burrell & Son, which has been standing unoccupied for a considerable period, was recently offered for sale by auction, but without any definite result. When a revival in shipbuilding does come in earnest, the shipbuilders of Dumbarton will be singularly well placed for the undertaking of large and important contracts, as the Harbour Board of the town has recently been supplied with a powerful Hopper Dredger, from the stocks of Messrs. Simmons & Co., of Renfrew, the well-known patentees and builders of this special class of vessel. With this powerful medium in the deepening and improvement of the Leven, Dumbarton may soon take up its rightful place in the ranks of *Cruiser* and *Greyhound* producing localities.

Attention may be directed in a word to the large proportion which sailing tonnage bears to the total tonnage recently ordered. In this connection it is noteworthy that the well-known Port Glasgow firm, Messrs. Russell & Co., have all through the present dulness, and for long prior to it, been kept singularly well employed in the production of sailing ships.

THE new steamer *Knight of St. John*, of Liverpool, Captain Shield, left the Tyne on Monday, 26th October, at 7 p.m., and arrived off Dover at 10 p.m. on Tuesday night, thus making 288 miles in 27 hours.

THE barque *Belt* has arrived at New York from Antwerp, having made the passage in 17 days and 22 hours. This is stated to be the fastest passage on record for a vessel of that class.

LAUNCH OF THE "CAMPERDOWN."

ON November 24th the launch of the armour-clad *Camperdown* at Portsmouth took place under very distressing conditions of weather. A cold November drizzle fell throughout the ceremony, which was greatly protracted, and comparatively little was visible to the majority of those present, owing to the remarkable display of umbrellas. In spite, however, of these depressing circumstances the various stands and all the positions whence a view of the gigantic vessel could be obtained were crowded with spectators, the workmen belonging to the dockyard being granted a half-holiday on the occasion. It was at first intended that the ceremony of naming and launching the ship should be performed by Lady George Hamilton, the wife of the First Lord of the Admiralty, but in consequence of the death of the Marquis of Abercorn, a change was rendered necessary. In these circumstances Mrs. W. H. Smith, the wife of a former First Lord, consented to undertake the duties. Shortly after 11 o'clock Mrs. W. H. Smith took up a position on the bow platform in front of a table on which were the appliances for breaking the bottle against the prow and for letting go the dog-shores. Among the spectators were Admiral Hoskins and Captain Codrington, of the Board of Admiralty; Mr. W. H. White, Director of Naval Construction; Mr. Evan M'Gregor, Admiral Key, Admiral Sir Harry Keppel, Admiral Sir G. P. Hornby, Admiral Superintendent Herbert, Captain Tracey, the Mayor of Portsmouth, and a number of naval and military officers. The usual religious service was read by the Rev. Mr. Williams, dockyard chaplain, and at ten minutes to one Mrs. Smith severed the silken cord with a miniature axe, and the ceremony of christening was performed with the customary libation of wine, the combined bands of the local marine forces uniting at the same time in playing and singing the National Anthem.

It was arranged for the launch to take place at noon, but an unexpected stoppage occurred. The ship had been set up by means of slices between three and five in the morning, and as the *Camperdown*, with all her side and bulkhead armour on board has a displacement of close upon 5,000 tons and a mean launching draught of 15 ft. 2 in., she is by far the heaviest vessel which has been launched at Portsmouth. This made the lifting of her a work of considerable difficulty, which, however, was successfully accomplished by Mr. Robert Barnaby, the constructor, and Mr. Lemon, the assistant constructor, in charge of the ship, and a cohort of shipwrights, with the exception of a part of the ship near the centre. Here a few blocks under the keel remained refractory, and could not be removed until an hour after noon, the time of high water. Beginning at the stern, block after block gave way under the heavy blows of the rams, but as those in the middle remained perfectly rigid and resisted the efforts of the workmen to remove them, it became necessary to saw them through, the more especially as the ship began to draw. No doubt the momentum of the immense structure, when free, would have carried her over all obstructions, but it was deemed expedient not to trust to chance. It was consequently close upon one o'clock when the cheers of the workmen announced that the last blocks had succumbed. Mrs. Smith thereupon in the midst of profound silence only broken by cries of "down umbrellas in front," cut the lanyards which held the dog-shores, and no sooner were they heard to fall than without any appreciable hesitation on the part of the ship the *Camperdown* glided down the ways into the harbour, her progress being attended by indescribable enthusiasm.

The *Camperdown*, barbette ship, was laid down on the 18th December, 1882. Her length over all is 380 ft.; breadth, 68 ft. 6 in; depth in hold, 22 ft. 6 in. Her draught of water when completed will be 26 ft. 3 in. forward and 27 ft. 3 in. aft, and she is to have a displacement of 10,000 tons, and engines of 9,500 H.P. The machinery, which is to be supplied by Messrs. Maudslay, Son & Field, costs £104,900, the materials for construction £27,900, and labour £19,600. Her armament will be the most powerful of the ships of the *Admiral* class, and is to consist of four 63-ton guns, mounted *en barbette*, six 6 in. breech-loading guns, twelve 6-pounder rapid-firing guns, four Gardners, four Gatlings, eight Nordenfelts, and twelve 18 in. Whitehead torpedoes. The thickness of the armoured sides is 3 ft. 8 in. On the outside of all is 18 in. of armour. Her armoured deck has two inches of protective plate and two half-inch thicknesses of steel. She has a bulkhead forward and another aft, each having 16 in. of armour and 12 in. of backing. The barbettes themselves have 14 in. of armour at the front and 12 in. at the sides, with 13 in. of backing. The screen bulkheads which run from the barbettes to the sides of the ship are each pierced for a 6 in. gun, but the

port can be closed at discretion, and the guns can be turned on a pivot to fight broadside. The chief object, however, in placing them in the screen is to enable them to fire either forward or aft should the big guns, which are always exposed, be disabled. Of the twelve 6-pounders four are to be placed on the upper deck and eight on the spar deck. The ship is pierced for five torpedo tubes, one of which is immediately under the crest in the bow of the ship, and is so constructed that the valve may be automatically opened and the torpedo fired in the direction the ship is going while the vessel is at her full speed of 16 knots. She is built to carry 900 tons of coal, and for a complement of 445 officers and men. The ship has unarmoured ends, and all her guns, with the exception of those in the tops, are to be within the belted citadel.

LIQUID FUEL FOR STEAMSHIPS.

INTEREST in the subject of substituting oil for coal, as fuel, in steamships, has been considerably quickened by the reported results attending the trials of the s.s. *Himalaya*, which has b.en constructed for a special trade, in which oil will form the most convenient and economical, if not, the most efficient fuel that can be used. The *Himalaya* is fitted up with capacious tanks for the oil carrying trade, on the coast of Brazil. She is so fitted that these tanks are drawn upon for the fuel requisite to supply the motive power for her own propulsion, the system adopted being the invention of Mr. Tarbutt, of London. The vessel made her first voyage, burning liquid fuel, from London to Leith, about the beginning of November, her cargo consisting of resin and oil, for Messrs. Fleming & Co.'s works at Granton. The voyage was accomplished in 54 hours, and the system was found to work most satisfactory. The consumption of oil on the voyage was a little over eight gallons per hour, costing it is said about £1 per day, while the cost of coal for that period would, it is calculated, have been £7. After the arrival of the *Himalaya* at Leith, several improvements in detail were made, and on the 16th inst. a series of experiments were instituted while the vessel lay in Leith harbour. A number of officials, managers, directors, chairmen, and shareholders, in large oil companies in various parts of Scotland, also shipowners and shipbuilders were present, on the invitation of Mr. Moyes, manager of the Marahu Oil Company, who own the vessel.

The exhibition was commenced at mid-day when the fires were lighted up and steam raised in a very short space of time. The general opinion was that the fires were as good as could be obtained by using coal, while steam was made very rapidly without any smoke whatever from the funnel. By adopting liquid fuel it need scarcely be said that in addition to the economy in cost a great saving will be effected in labour. Where five firemen would be required with coal as the fuel, two will suffice with oil, the furnaces being easily fed and no accumulation of ashes having to be removed. A great saving will also be effected in the outlay for tools for the firemen, and for the appliances requisite in loading the vessel with coal. Not only so, but, owing to the comparatively small space required for oil fuel, the space ordinarily available for the stowage of cargo will be immensely augmented. Shipowners and marine engineers will watch the development of the important experiments now being carried out in every day practice with the utmost interest.

DEEP SEA SALVAGE OPERATIONS.

A telegram has been received by the Marine Insurance Company from Captain Stevens, steamship *Arabian*, stating that the diver Lambert has recovered one box of gold from the mail steamer *Alphonso XII.*, which belonged to the Lopez Line, and, while on a voyage from Cadiz to Havana in February last, sank off Point Gando, Grand Canary, and that the recovery of the remainder is certain. The value of treasure is over £100,000. The divers had to work in the great depth of 25½ fathoms. The upper and lower decks of the saloon had to be blown away so that the bullion room could be reached. Special diving apparatus had to be constructed for the work by Messrs. Siebe, Gorman, & Heinke. It may be remembered that Lambert is the diver who so courageously walked up the Severn Tunnel when it was flooded and succeeded in closing the iron door which enabled the pumps to overcome the volume of water.

PRICE & BELSHAM'S PATENT AUTOMATIC FEED DRILL.

WE have much pleasure in bringing to the notice of our readers a very simple form of drill, invented by Messrs. Price & Belsham, of 52, Queen Victoria-street, E.C., and exhibited by them at the late Inventions Exhibition.

In this tool, which is applicable to every purpose, two most important additions to, and improvements on, the ordinary ratchet brace have been successfully introduced, and it is thus made to combine all the requirements of a bench drill and a ratchet brace.

The first point which calls for attention is the continuous motion of the drill spindle, which being obtained by both the forward and backward motion of the handle, effects twice the amount of work of an ordinary ratchet brace in the same time. This continuous motion is obtained by means of mitre wheels and clutches, actuated by the usual backward and forward motion of the handle, and as all the moving parts are thoroughly enclosed and protected by the casing, there is no likelihood of their being damaged or getting out of order, the requisite strength being obtained by constructing the whole of the tool entirely of steel.

Perhaps, however, the greatest improvement embodied in this tool is its entirely automatic frictional feed, which not only ensures the drilling of holes with rapidity and satisfaction, but completely does away with that most fruitful source of annoyance—the continual breaking of drill bits, due to the excessive and intermittent feed that must be given to the ordinary ratchet brace to make any progress at all. With this tool the necessity for the operator to trouble himself about putting on the feed every few minutes is entirely obviated, as this is done automatically, evenly, and regularly, as required, by a frictional action which prevents the feeding screw from moving until a sufficient cut is obtained, hence the expensive and vexatious delays in repairing and regrinding the drill bits (to say nothing of the serious inconvenience in case the repaired drill varies in diameter from the first one), are entirely avoided, as the usual cause of these breakages is completely removed.

It will be seen from our illustrations, which show the drill in two forms of stand, that it can readily be changed from the bench stand and attached to the universal stand. This is accomplished by removing the nut on the back of the hollow arm. This arm also carries a spindle, to which a pulley can be attached when it is desired to drive the drill by power. The universal stand is especially provided with a slotted flange coupling fitted to the horizontal arm. This admits of the drill being fixed to work at any desired angle.

We need scarcely point out to our readers the advantage of having such a tool as this in the engine room, nor need we enumerate the many purposes to which it is applicable; but we can say from personal inspection that so far as workmanship, design and construction, and lowness of price are concerned, this tool leaves nothing to be desired.

THE wreck of the Allan Line steamer *Hanoverian*, which ran ashore on the 2nd September near Cape Race, has been sold for 1,000 dollars.

PRICE AND BELSHAM'S PATENT AUTOMATIC FEED DRILL.

MESSRS. ANDERSON AND GALLWEY'S HYDRAULIC MACHINE TOOLS AT THE INVENTIONS EXHIBITION.

THE exhibit of this firm at the late International Inventions Exhibition fully maintained its well-known reputation both for excellence of design and high quality of workmanship and materials. The illustrations herewith given represent a few of the tools and machines then exhibited, and which are most likely to be of interest to our readers.

FIG. 1.

FIG. 2.

Starting with the source of power for actuating the different tools, it will be seen from Fig. 1 that the pump specially designed by the firm for this purpose is characterised by great solidity of design, and by the facility with which all the working parts can be reached. In this pump the steel crank shaft actuating the plungers passes through gun metal bearings firmly held by the frame, which is cast solid round their upper portion, and therefore itself receives all the strain of the upward thrust direct, and not through keys or bolts. These pumps are intended to be worked by belting from the main shafting of the shop, and are for this purpose provided with fast and loose pulleys, of which the former, by reason of its breadth of rim, acts as a flywheel.

Perhaps the tool calling most for our attention is the Patent Flush-topped Fixed Rivetter. This type of rivetter, known as the "Eagle," is shown at Fig. 2, and embodies all the improvements the firm have made in these machines. The flush top of this machine enables flues and similar work to be operated upon, and by means of the patent automatic return stroke the rivetting die is brought back immediately the man releases the foot lever, an improvement, we believe, embodied only in machines made by this firm. A further improvement, a patent adjustable cut-off gear, instantly regulates the stroke of the rivetting die to any required length by means of tappet gear, effecting a saving of both time and labour on the old plan of changing the dies for every fresh length of rivet, and for variations in the thickness or number of plates to be closed. The improved starting gear can be worked by the foot on either side of the machine, thus leaving the hands free to manipulate the work between the dies. One or these machines, supplied to the Compagnie Générale Transatlantique, is stated to be one of the most powerful rivetters yet made, closing as it does, the plates and rivet with a pressure of 120 tons at each stroke.

Amongst the many excellent portable rivetters made by this firm, our illustrations (Figs. 3, 4, 5, and 6) show some of those best adapted to the purposes of our readers. These are all of great simplicity and have no complicated gear to get out of order, the valves in all cases being of the improved form, requiring no leathers, which renders them perfectly reliable. These valves are evenly balanced, and the effort required to open or close them is so small that there is no tendency to shift the dies from the rivet head whilst doing so.

It will be seen that the first two types are of the "Bear" form, the others being of a type called the "Lion." The latter are formed of two steel arms work-

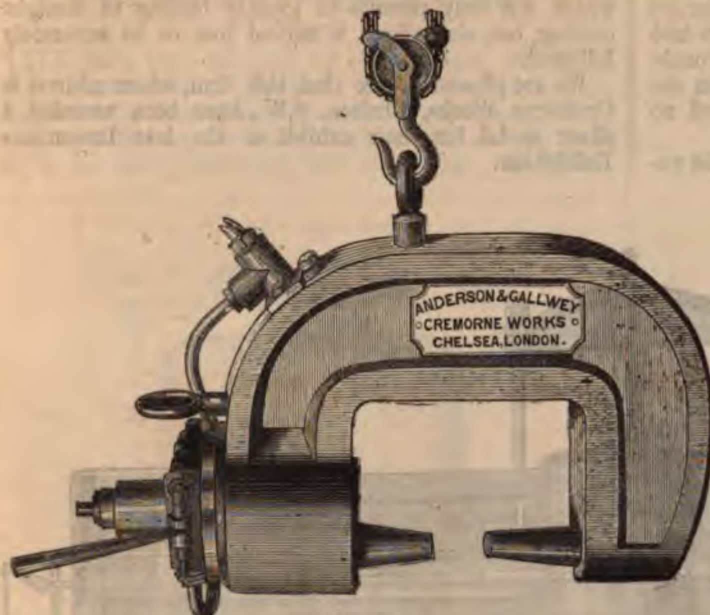


Fig. 3.

Fig. 5.

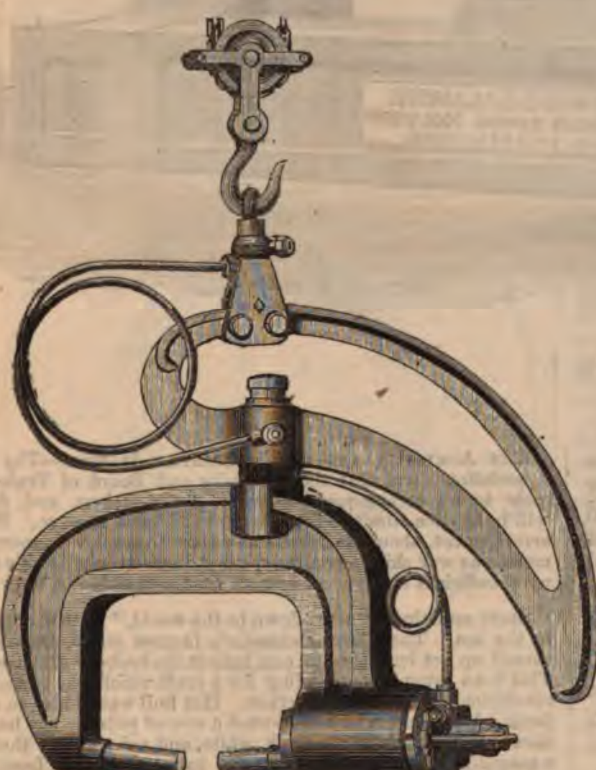


Fig. 4.

Fig. 6.

ing on a steel pin, one end of the arms carrying the cylinder and ram, and the other the dies. The latter are thus quite clear of the working parts, and can reach into corner work, &c., on which a direct-acting machine could not be used. The various methods of suspension are sufficiently clearly shown in the figures as to need no explanation from us.

Fig. 7 shows a machine which, though not in the exhibition, possesses sufficient interest to merit description here. It is an improved hydraulic shearing machine for shearing up to $1\frac{1}{2}$ in. plates, and was recently constructed for a large rolling mills in Belgium, and is the largest machine of its kind in existence. The frame is formed of two long cast-iron girders united at the ends by uprights, and carrying the cylinder, ram, and shearing blades. This permits plates of great width and of unlimited length being operated upon. The main ram has an automatic return motion, by which the shear blade is brought back immediately the valve is released, provision being made for working this at any point along the machine.

The stroke of the shears can be regulated to any required length by means of adjustable tappet gear, and unlike the practice usually followed in large machines of this class, the blades have been kept comparatively short, which not only permits of greater facility in straight cutting, but also allows a curved line to be accurately followed.

We are pleased to see that this firm, whose address is Cremorne Works, Chelsea, S.W., have been awarded a silver medal for their exhibit at the late Inventions Exhibition.

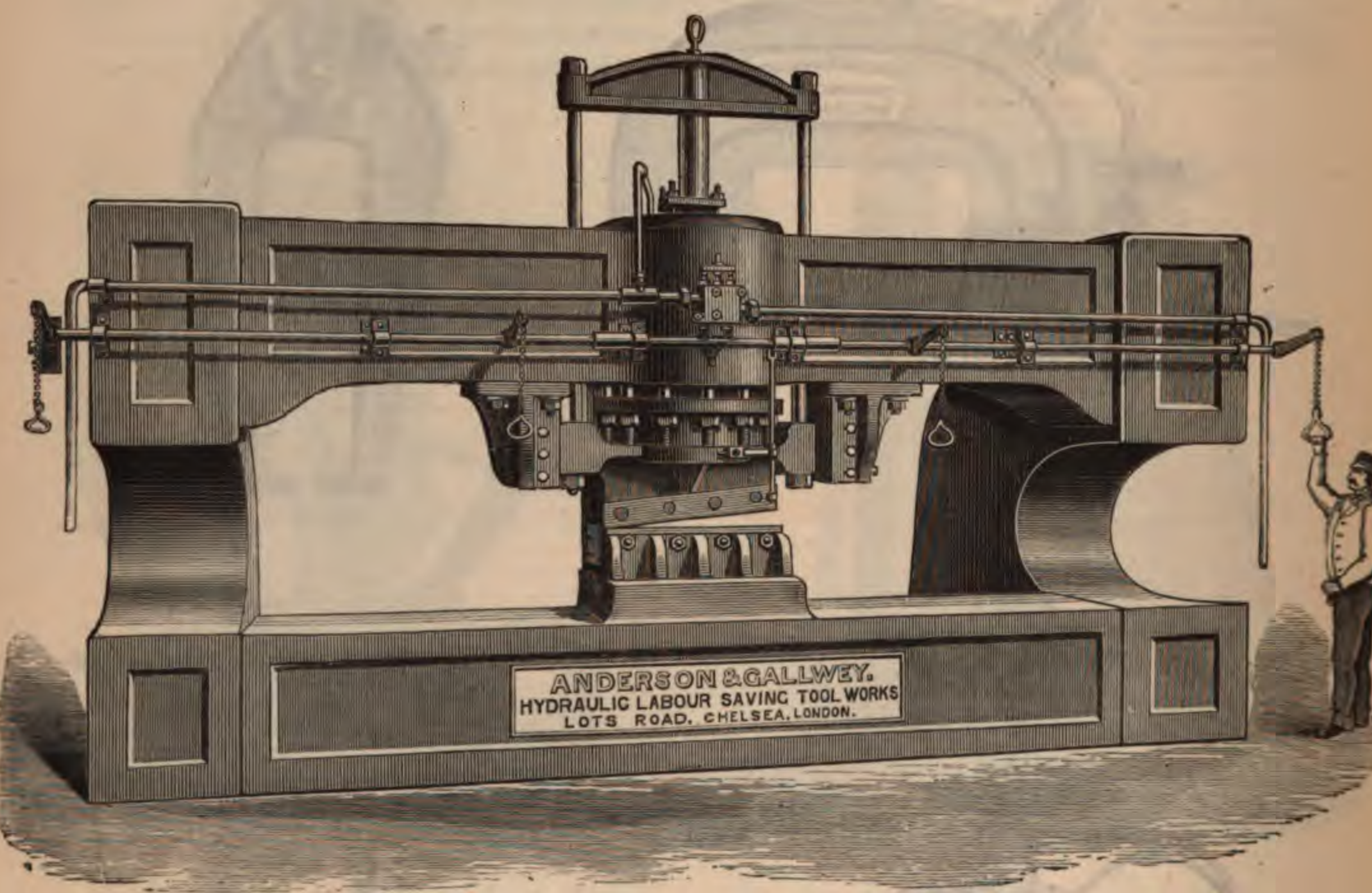


Fig. 7.

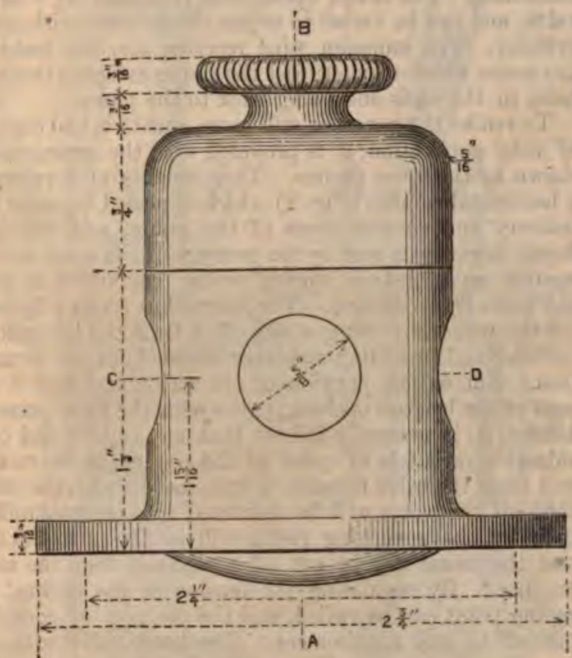
The Admiralty and the Mercantile Marine.—The Press Association learns that the Admiralty and Board of Trade have come to an arrangement whereby 2,000 stokers and firemen will be at once admitted into the Royal Naval Reserve. By this arrangement, should it become necessary to employ the mercantile marine as war ships or cruisers, the Admiralty will be able to call upon sufficient stokers and firemen for the working of the vessels.

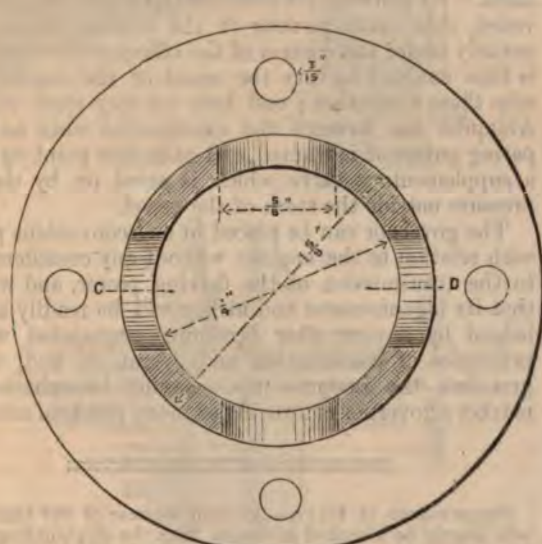
Ships sometimes "come down in the world," instead of sinking in the sea. The Czar Alexander's famous yacht, the *Livadia*, turned up not long ago as a coal hulk in the harbour of Sebastopol. This is an ignominious ending for a craft which was expected to revolutionize marine architecture. Her hull was hidden in a projecting basement, which supported a row of pillars; she had four tiers of decks paved with black, white, and red marble; there was a magnificent marble fountain; the baths were hewn from white marble blocks; rows of electric lights illuminated the saloons and avenue-like corridors, and the many sets of apartments were finished in rare woods and stones. But the *Livadia* was not a safe sailor, and she was practically discarded as worthless.

SELF-ACTING PLUG FOR BOATS.

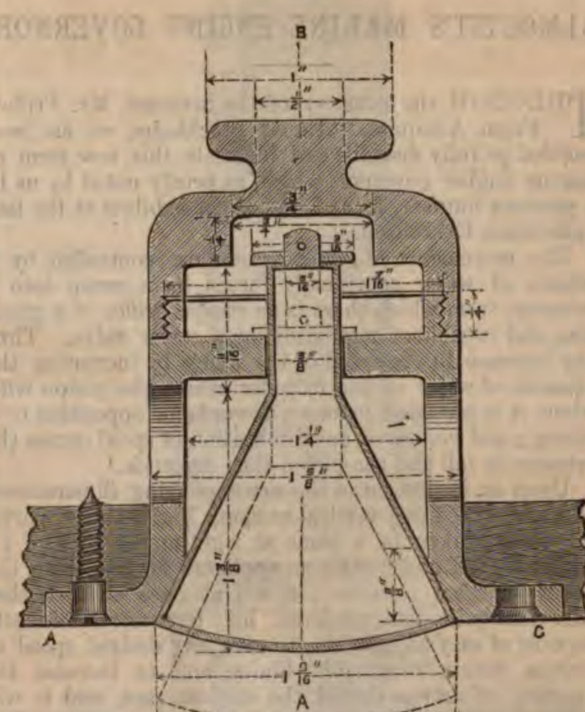
WE have been favoured by the inventor, Mr. J. A. Correâ, chief engineer, Brazilian Navy, with drawings of a floating valve brought out by him.

A reference to the illustrations, which are so clear as to be self-explanatory, will show that the valve,





formed as a hollow truncated cone, and its fittings are screwed into the bottom of the boat which they are intended to drain. So long as the boat is in the water the upward pressure on the valve keeps it closed, but immediately the boat is lifted the valve falls by its own



weight, and the boat drains herself of any water that may have accumulated.

The valve spindle can be readily got at for cleaning by unscrewing the upper portion of the casing, and as this in no wise affects the working of the valve it can be taken off either when the boat is high and dry or when she is afloat.

The arrangement is neat and simple, and we commend it to such of our readers as are interested in boat building.

Addition to the Russian Navy.—On November 2nd, the Emperor and Empress of Russia arrived at Gatschina to launch the new armour-plated cruiser the *Admiral Nakhimoff*, at the Baltic Works, and also to lay the keel-plate of another vessel, a torpedo cruiser of the most modern description. The talented and popular head of the works, M. Casey, received their Imperial Majesties and others, and on their departure entertained a large number of admirals, engineers, and members of the press at luncheon. The *Admiral Nakhimoff* is another of the so-called Admiral ships of recent construction. She was begun in December, 1883. Her measurements are:—Length along loaded water-line, 333 ft.; breadth of beam, 61 ft.; medium depth, 25 ft. 3 in.; displacement, 7,781 tons; compound engines, 8,000 indicated strength; armament, eight long-range 8 in. guns, ten 6 in. guns, and torpedo cannon. This is the first warship in which all the steel and iron used is of Russian home production. The torpedo cruiser, *Ileen*, now begun, is named after Lieut. Ileen, who assisted in burning the Turkish fleet in Tchesme Bay, in July, 1770, after a fight in the channel of Scio. Although English and German historians assert that the fireships sent against the Turks on that occasion were directed by the English officers in the Russian service under Count Orloff—Lieutenants Dugdale, Mackenzie, and Elphinstone—the Russians now claim the chief merit of that great exploit for Lieut. Ileen.

It is stated that a shipbuilder, at the lower part of the Tyne, has accepted an order to build a steamer of between two and three thousand tons, for £7 per ton dead weight. If the rumour is correct this is an immense reduction on the prices accepted two years ago.

ALMQUIST'S MARINE ENGINE GOVERNOR.

THROUGH the courtesy of the inventor, Mr. Fridolf Frsan Almquist, C.E., of Stockholm, we are now enabled to fully describe and illustrate this new form of marine engine governor, which, as briefly noted by us in a previous number, formed one of the exhibits at the late Inventions Exhibition.

The movements of the governor are controlled by a stream of water continually forced by a pump into a cylinder, from which there is an escape orifice of a given size, and capable of regulation by a screw valve. Thus any increase in the speed of the pump by increasing the pressure of water in the cylinder causes the piston with which it is provided to move upwards in opposition to a spring; and *vice versâ*, any diminution of speed causes the pressure to fall and the piston then descends.

Upon an inspection of the accompanying illustrations, of which Fig. 1 is a vertical section; Fig. 3 a view, partly in section, taken in a plane at right angles to Fig. 1; whilst Figs. 4 and 2 show an appliance for rendering the governor more sensitive; it will at once be seen that Mr. Almquist has rendered his governor eminently capable of easy adjustment, to give any desired speed of engine within reasonable limits, and to increase the rapidity of action should the engines race, and it will also be obvious, from the following description, that this governor will act rapidly at whatever speed the engines may be running, even when going slow, as in fogs, &c.

By a strict attention to mechanical details, and by a judicious elimination of all stuffing boxes, and other irregular sources of friction, the inventor has succeeded in producing an apparatus, which when once adjusted, may be reasonably expected to give uniform results; a great advantage over most of the marine governors now in use, their general fault being the necessity of accurate setting of the stuffing boxes.

It will be seen from the illustrations that there are two cylinders, the smaller, or controlling one, being immediately under the valves, which it gives motion to, while the larger, or governing ones, actuates, by means of its piston, the throttle valve of the main engines, and also a piston valve connecting the "receive" within the condensor, and by thus causing a vacuum on both sides of the low pressure piston, the governor serves to deaden the force of the large as well as the small cylinder.

The piston of the governing cylinder is operated by steam admitted through the pair of differential valves, the inner one of which is operated by the controlling piston, while the outer one is actuated by the swinging lever, attached at one end to the small cross head, and at the other end to a sway lever, and its dependent link, as shown.

As will be seen, the motion of the outer valve tends to neutralise that of the inner one; thus, if the speed of the engine should increase, the inner valve is raised by the controlling piston (consequent on the increased pressure of water under it) and admits steam to the lower end of the governing cylinder, while it exhausts it from the upper end. This raises the piston which draws up the outer valve with it until the ports in it are again closed by the inner valve, when the piston comes to rest and remains fixed until the governor again comes into action thus the action of the governor is in direct proportion to the variation of speed, and it does not work merely as an ordinary "cut off" governor. The power cylinder is enclosed within an outer casing, the whole being filled with water and always kept full by the condensation of a small quantity of steam. There are two openings into the lower part of this cylinder, connected by pipes with a pump driven by the engines, of which the speed is to be controlled. The outlet opening is regulated by a screw valve, and can be varied to adjust the pressure within the cylinder. The emission pipe receives also the leakage, any water which may get past the piston escaping through holes in the walls and going back to the pump.

To render the governor still more sensitive, and capable of wider application, it is provided with the arrangement shown by the lower figures. This consists of a valve on a horizontal spindle (Fig. 2) which is placed between the delivery and suction pipes of the pump, and which is forced towards its seat by the pressure of the water acting against an adjustable spring whose tendency is to push the valve from its seat. The valve thus forms a by-pass for the water, diverting a part of it from the controlling cylinder and providing a shorter channel for its circulation. But as the position of the valve, and with it the area of the by-pass opening, varies with the fluid pressure behind it, it naturally follows that any sudden and considerable variation of speed of the engine, as in racing, will force the valve towards or into its seat with the effect that all the water will be delivered into the controlling cylinder, the governing piston will be driven to the top, and the steam will be cut off completely from the main engines. By regulating the tension of the spring, the racing point can be varied, and the position of complete cut off to any requirement. The lower valve with the lever handle shown in Fig. 4, placed between the delivery and suction pipes, supplies a further means of adjustment. By suitable connections from the bridge of the vessel, this valve permits of the engines being placed entirely under the control of the officer of the watch, who is thus enabled to vary the speed of the engines or to stop them altogether; and here we may state that Mr. Almquist has foreseen the emergencies when an anticipating governor is wanted, and gains this point by adding a supplementary valve which is acted on by the water pressure outside the stern of the vessel.

The governor can be placed in any convenient position with relation to the engines without any consideration as to the transmission of the driving power, and we think that its ingeniousness and utility will be readily acknowledged by anyone after becoming acquainted with its principles of construction and operation, and we congratulate the inventor upon having brought into the market a governor embracing so many points of excellence.

SHIPBUILDING IN ITALY.—An iron steamer of 300 tons burden will shortly be launched at Genoa, from the shipbuilding yard of Messrs. E. Cravero, marine engineers, at La Foce. She has been built for a Genoese shipowner, Mr. A. Nain, who, since 1878, has established a regular packet service between Genoa and Rome. This vessel will be the largest that has hitherto ascended the Tiber as far as Ripa Grande. A contract has been given by the Italian Government to the same firm for building four sea-going torpedo boats. They are to be 40 metres (131·1 ft.) in length, and are to be delivered in eighteen months. The total cost will exceed £40,000.

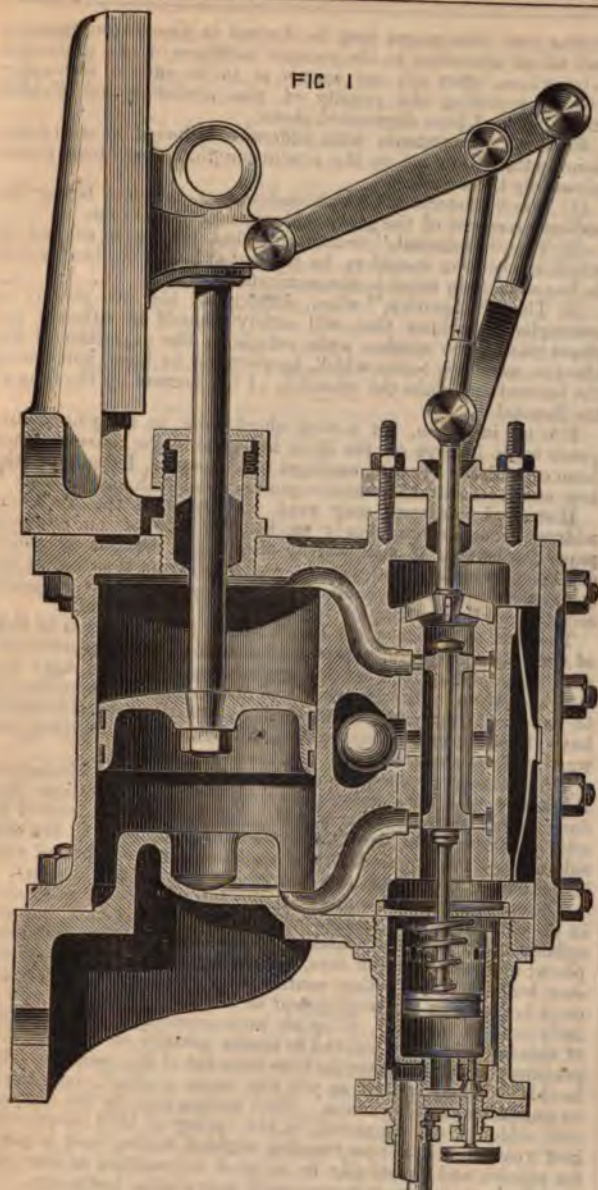


FIG. 1

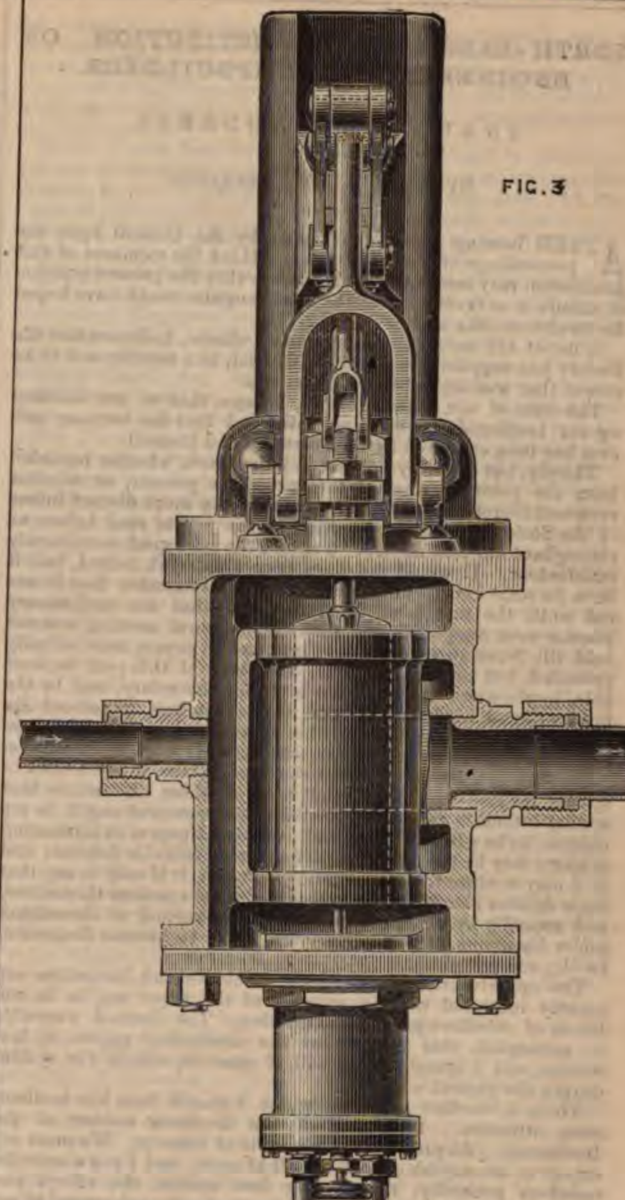


FIG. 3

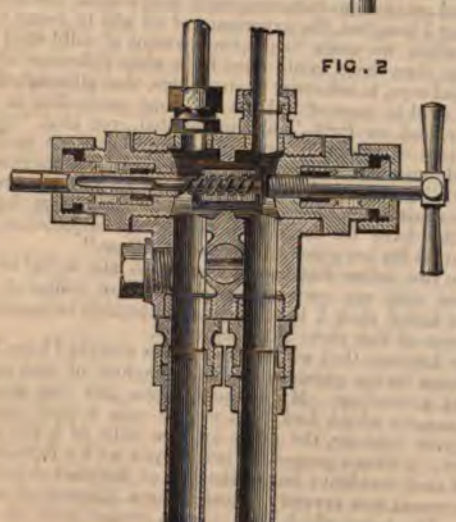


FIG. 2

FIG. 4

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

INAUGURAL ADDRESS.

By W. Boyd, Esq., President.

AFTER hearing the Report made by the Council upon the proceedings of the last Session, I think the members of this Institution may congratulate themselves that the present position of affairs is as favourable as the most sanguine could have hoped for twelve months ago.

A list of 452 enrolled members, of all classes, indicates that the Society has supplied a want of the district, in a manner and to an extent that was desired by its promoters.

The state of our finances shows, I hope, that we are building up our Institution on a sound basis, and that due economy and care has been exercised by the Secretary and Council.

Thirdly, but certainly not last in importance, whether regarded from the point of view of the immediate present, or whether reviewed in reference to its influence on the more distant future of the Society, comes the question of the papers read before us throughout our first session. I regard the retrospect as eminently satisfactory. It would not have been wonderful, indeed, had it been (to some extent) otherwise. You will remember that it was not until the month of November last that our preliminary labours were completed, and that the inaugural meeting was not held till November 28th. At that time no papers were actually promised, but between that date and May of this year we were able, by the great energy of our late Hon Secretary, and by the good will and hard work of some of our members, to present six papers for your consideration, all of them of value, and all of them communications of the type and character we wish to encourage.

On each of these papers discussions took place, in some cases of special interest and value, and it is to these discussions that special attention and every possible encouragement ought, in my opinion, to be given. Short, well-considered papers on interesting subjects may be the means of giving rise to valuable debates; and if I may venture to add a word of caution, it is only to say that these debates should, in the first place by the speakers themselves, and secondly by the chairman, be rigidly confined to the subject under discussion, otherwise they are liable to become discursive, feeble, and parochial.

The opportunities for satisfactory debates and discussions are greatly increased when a synopsis of the paper can be in the hands of members prior to the meeting. The Council were able to accomplish this in some of the concluding papers of last session, and I imagine they will, if possible, extend the system during the present winter.

There is another subject to which I should here like to direct some attention. It is that of the Graduate section of the Institution. At present it is in a state of infancy. We must not expect to accomplish everything all at once; and I can assure the members generally, that during last session the efforts and energies of the Council were so occupied with endeavours to get the Institution as a whole into working order, that they had no leisure or opportunity to give special attention to this matter. At the close of the last session we had 39 enrolled graduates, and I feel convinced that a considerable accession to these members ought, and must be made without delay. If one considers the number of young men in a state of pupilage, employed in shipbuilding and engineering works in this district, it must be evident there ought to be a large and fertile field for the enlistment of recruits, to whom familiarity with the usages of such a Society as this, and by degrees the acquirement of the power of expressing their opinion and ideas before an assemblage of critical friends, would prove an immense advantage and gain to them in after-life.

Whether it would be well to aim at the establishment of a separate Graduate section is a matter for careful consideration, and on which I am hardly prepared to offer a definite opinion. The constitution of our Society differs in some respects from that of the similar society in Scotland, insomuch as many of those who in that society find a place in this Graduate section are, with us, full-blown "members." Moreover, I am one of those who believe in the maxim that "unity is strength," and that we should be careful, lest, in modifying too rapidly our present constitution, we weaken the efficiency of the whole. Be this as it may, I do without hesitation commend this matter not only to the Council, but to the general consideration of our members, feeling sure that means may be devised to give encouragement and afford attraction to the younger members of our profession —by whom, after all, our science is to be carried forward—without incurring the penalty of the weakened and divided efforts which I have deprecated above.

From my acquaintance with addresses delivered on such occasions as this, I am led to the conclusion that they divide themselves into three classes.

(1) The "Historical," which endeavours to place before the audience a *resumé* of the great achievements of the past.

(2) The "Technical," treating of that particular subject in which the speaker considers he is most at home, or about which he has something novel to communicate.

(3) The "Suggestive," when, diffident of his own powers to accomplish anything that will satisfy himself in either of the above classes, the speaker seeks refuge in the exposition of his ideas on some few topics which, he ventured to hope, will arouse the interest and claim the attention of his hearers for the time at his disposal.

It is my intention, for a very short time, to ask your indulgence while I move on the lines indicated in the last-mentioned form of address, because, amongst other reasons, I think it is the true and most suitable course to pursue upon such an occasion.

Historical addresses may read *ad nauseam*; the Technical address trenches too closely on the province of an ordinary paper; whereas, if any worthy theme for thought or action can be suggested by the remarks which fall from the chair at the commencement of the session, the objects for which such-like societies are formed may be helped forward and assisted.

The first subject to which I wish to ask your attention is that of the employment of mild steel for various purposes connected with shipbuilding and marine engineering. At first sight this may appear an "oft told tale," and one on which it is impossible to say anything new or interesting; but some considerations have lately come to my notice which, in my judgment, are worthy of careful attention.

Those among us who are members of the Institute of Mechanical Engineers will have noticed—and doubtless some others have done so, likewise—that the President of that society devoted his address, delivered at the summer meeting in Lincoln, to the consideration of the applicability of steel to a large number of constructions, ranging from the Atlantic liner to railway sleepers.

The success which has attended the introduction of mild steel in the construction of marine boilers is so marked that but one opinion exists as to the stability of this material for such purposes; and, as Mr. Head says, "marine boilers are now scarcely ever built of iron." One contributing cause for this development is doubtless the employment of the higher pressures now in daily use; or, perhaps, to speak more correctly, the capabilities of this material have assisted to render possible such advances in pressures as would otherwise have been out of the question. But, be this as it may, call it as you like, cause or effect, there can be no question as to the success. Steel boilers built by the company with which I am connected, in the spring of 1878 (seven and a half years ago), are now running without having cost a penny for repairs, and practically in as good a condition as ever; and doubtless other manufacturers could bear similar testimony.

So far, I imagine, the experience of all will be found to agree.

But when we come to the employment of mild steel for shipbuilding, then there would seem to be some difference of opinion. Mr. Head says, in reference to steel ships, that although the advantage of steel in cases of "slight collisions, grounding in moderate weather, and so forth," are undoubted, yet that "there have been cases of steel ships returning from voyages more or less strained, and out of shape in a way rarely experienced previously;" and further, that the severity of the tests applied to steel materials by Lloyd's Registry is "suggestive that Lloyd's committee have for long been themselves apprehensive that 20 per cent. is far too great a reduction to allow."

These two latter statements seemed to me to be so much at variance with my own experience, and so different from the general belief, that I have taken some trouble to inquire into the soundness of the views thus expressed.

It so happens that within the last few months I have had direct experience on the question of the behaviour of iron and steel in cases of grounding. My company have just had under repairs two steamers which had been ashore—one a steel ship of 1,361 tons gross register, the other an iron ship of 2,190 tons gross register. I do not propose to trouble you with a detailed description of each accident; but in the case of the steel ship the bottom of the vessel was severely indented for a distance of upwards of 30 ft. The point which first came in contact with the rocks was

situated on the port side, about 5 or 6 ft. outwards from the keel, and about 20 or 25 ft. from the stem, and the indentations continued for a length of about 30 ft. abaft of this point. These indentations existed between each frame about 2½ to 3 in. deep in worst places, gradually diminishing towards the after end of the ship. About one dozen of the frames were cracked and broken through the rivet holes, and a very large number of the small intercostal plates were curled up exactly as if they had been flanged in a smith's fire. Notwithstanding this severe punishment, thirteen shell plates out of fifteen were heated in the furnace, straightened and replaced. The remaining two plates, however, were so severely crushed by the heel of the frame to which they were attached as to be condemned; but they showed no signs of fracture, and all the small intercostal plates were straightened and replaced. To such an extent was this restoration carried on, that 78 per cent. of the material damaged by the accident was repaired and restored to its original place in the vessel.

In the case of the iron ship the damage caused by the accident was much more severe. The injury lay more in the centre of the ship, and extended from about 20 ft. abaft the stem for a distance of some 170 ft. towards the stern. The bar keel was forced up or hogged some 3 or 4 in., which was transmitted through the centre keelsons and hold stanchions to the 'tween and upper decks, even resulting in the fracture of the hatch combings. About eighty-four shell plates were damaged, with corresponding injury to floors, frames, and reverse bars, as well as the fore and aft girders in the water ballast tank. According to the best estimate I can make, only about 33 to 35 per cent. of the damaged material could be worked in again.

I do not wish it to be understood that in this case of the iron ship the damage could, under any circumstances, have been limited to the extent to which the steel ship suffered, for I must admit, that in the iron ship the seat of the injury lay in that part of the vessel where it was most readily communicated to the rest of the structure; but, notwithstanding this admission, I do believe that if she had been built of steel the injury would have been less extensive and more localised. The difference seems to me to lie in this, that the more pliable material lends itself more easily to local injury, and that the damage is thus confined within narrower limits, whereas, in the case of the more brittle material of iron, the local injury is more thoroughly transmitted into the general structure of the vessel, and in this way becomes more extensive. In addition to this the softer material can be straightened and replaced in a manner not possible, to the same extent, with iron plates and angles.

With regard to the "straining" of steel ships, and the "reduction of 20 per cent." in the scantlings, no direct evidence has come under my personal notice, but the first authority in the country, Mr. Martell, the chief surveyor for Lloyd's Registry, speaking at Glasgow, says that his attention having been called to the matter, he has made himself, and had caused to be made from Lloyd's surveyors at the outports, "exhaustive inquiries," and that in no case could he find it clearly proved that a steel ship "had failed for want of general structural strength," even after "having done heavy work, carrying dead weight cargoes." He did find, however, that some steel ships had strained locally, but that this was due to oversight, where "the continuity of strength was not kept up." This is Mr. Martell's evidence, and, I consider, places the matter on a very different and much more satisfactory footing.

In his speech in Glasgow, Mr. Martell made no reference to the 20 per cent. reduction of scantling, and I therefore took the liberty of communicating with him direct, and in reply to my question he writes to me:—"No reliable evidence, to my knowledge, has been adduced showing that the 20 per cent. reduction from iron, admitted by Lloyd's Registry, was too great as a maximum."

This question of the employment of a pliable material, such as mild steel, is of paramount importance to this district, for this reason, that for the production of the material now in use our local Cleveland iron is inapplicable. As you are all well aware, mild steel is produced in the Cleveland district from Cleveland ores on what is called the Basic process, which complies with all Lloyd's requirements except in regard to the tensile test, which at present ranges from 28 to 32 tons, whereas the Basic steel ranges from 24 to 27 tons; and though I may have appeared to question some of the conclusions of my friend, Mr. Head, I do most cordially join him in the hope that some modification of Lloyd's rules may be made to allow of the use of our local steel in vessels classed under their Register. It will at any rate be a "tested" material, and to this extent at least would possess, in my judgment, advantages over such iron as is commonly used in shipbuilding; and even if vessels were constructed of scantlings somewhat thicker than allowed under the present rules for steel, we should surely have structures equally reliable and trustworthy, while combining such advantages for repairs as I have endeavoured to indicate above.

While I write I am informed that a very careful investigation into the character of this Basic steel is being conducted at this moment in the Cleveland district by Lloyd's surveyors, and the result of that inquiry will be looked for with great interest by all concerned in the shipbuilding and shipowning of the North-East Coast.

I desire now to lead your thoughts in a different direction.

During the last few years the Council of the Institute of Mechanical Engineers has devoted certain sums of money to the encouragement of original research and investigation, and committees have been appointed to deal with subjects such as Friction, Rivetted Joints, &c., &c. Similar action is customary in our local Mining Institute, and several other societies. I must admit that our circumstances differ from those of the two wealthy bodies I have named; but it seems to me that in this direction the efforts of such a society as ours might advantageously be exerted. Such researches do, in my judgment, give a practical usefulness, and many times result in sound reliable information being elicited, not only to the benefit of science generally, but also in a secondary way raise the standard of the institution by which they are conducted, and remove from it the reproach that its labours are confined to the expenditure of paper and printer's ink, with the addition of the vice of too much talking. In an extreme youth like ours, barely moved from the nursery, great efforts in this direction cannot be expected, but we might, I fancy, make a beginning. We have a small balance in hand, and possibly some of our wealthy members might (if they approve of such a course) make a timely "grant in aid," but I suggest whether it would not be possible during the coming session to inaugurate such a custom which might lead to greater things hereafter.

The question of friction, and the best mode of applying lubricants, has, as I have said, been dealt with to a certain extent by the Mechanical Engineers, and they have also dealt very fully with rivetted joints, but in each of these cases there is still a wide field for further inquiry left remaining. Then there are numberless questions of shop management, such as the best form of punch and die, the best form of cutting tool, or the best form of drill, on which subjects a certain amount of experimental inquiry has been made, and given to the public, but which might be advantageously collected, and, either with or without further investigation, placed in a collected form, and be valuable and useful to those in whose hands such reports are placed. Another example is that of "forced draught," about which much has been written and on which much money has been expended, and which is undoubtedly a matter that must engage the practical attention of engineers in the near future, but about which, nevertheless, our knowledge and information is at present vague and incomplete. Any one or more of these subjects might, I think, be examined into and reported upon by committees of such an Institution as ours at comparatively small cost, and still the result might be greatly to our collective and individual benefit.

Following upon these, another and most important subject has for a long time occurred to me to be in a most unhappy condition —I refer to what is known as "nominal horse-power." The condition of this matter can only be described as one of absolute chaos. It is impalpable, undefinable, and, moreover, absolutely useless as an indication of relative value. Some may say that the question is entirely a commercial one, and as such ought not to come within the range of our attention as a scientific or practical body. With this view I do not concur, for the simple reason that some convenient mode of comparative definition of the power of machinery is absolutely necessary, and if such a society as this could contribute to place such a matter on a sounder basis, and one which should, at one and the same time, be scientifically correct and commercially convenient, its efforts would not, I think, be wasted.

It may be within the recollection of some present, that, in the year 1878, an inquiry into this subject was commenced by the Board of Trade and Lloyd's Registry, and the views of many engineers were solicited thereupon. Among those who went most exhaustively into the question was my friend Mr. F. C. Marshall, who drew up a very careful report on the whole subject, and proposed certain formulæ for general adoption. Time will not allow me to lay these before you in detail; suffice it to say, that Mr. Marshall took as his starting point that the speed and stroke of the piston and the working pressure in the boiler

should form elements in the calculation, instead of confining it to simple diameter of the cylinders, as was then, and is still, the very insufficient method in use. At that time the triple expansion engine was unknown, and the formulæ proposed merely had reference to four types—the compound screw, the compound paddle, the simple expansion screw, and the simple expansion paddle engine.

The value of the suggestion was fully admitted by the two bodies I have named; but Mr. Parker, reporting to his committee in Sept., 1878, stated that as the difficulties in formulating a rule universally applicable were, apparently, so great, and as the description "registered horse-power" was so misleading, he recommended that it should be omitted altogether from the register book. The committee did not, however, see their way to adopt Mr. Parker's recommendation, and the matter was allowed to drop. Mr. Trail also wrote in July, 1878:—"The more we go into it, the more apparent the difficulties become."

Where such eminent authorities have failed, it seems presumption for others to expect any measure of success; but events move fast now-a-days, and it is seven or eight years ago since this inquiry was made, and in view of the able men we number among us, capable, as engineers, of dealing with the vendor's side of the question, or as shipbuilders and shipowners with the purchaser's side, it does not strike me as wholly beyond the bounds of possibility that a renewed investigation of the matter at this time might lead to a report from such a society as ours, which might, at any rate, usefully call attention to present anomalies and absurdities, and be the means of assisting those in authority, and others concerned, to adopt some more sensible, scientific, and sound calculations. The newer types of engines now coming into use seem to point to the present as a singularly opportune moment at which to approach this inquiry. Old ideas will have to be abandoned, and old methods improved upon, and I can conceive it possible that careful inquiry might recommend the entire disuse of the misleading term of "nominal horse-power," substituting in its place that of "indicated" or "developed horse-power"; but in spite of the difficulties, which must be obvious to the most cursory observer, I venture to commend the matter to your attention, and especially to that of the Council of the Institution.

I cannot resist the opportunity of alluding to one more subject —though, I fear, I have detained you too long already—and it is one to which I also made reference last year.

Professor Lyon Playfair, in his address to the British Association, reminded his hearers that it was only 300 years since we became a manufacturing country, and that, according to Professor Dewar, in less than 200 years more the coal of this country would be wholly exhausted, and in half that time difficult to procure. Even the shorter period may appear sufficient to serve our purpose, for I suppose, long before this, the coal, like the land, will be divided up into three-acre plots, with a cottage, and garden, and pig; but the Professor used the above statements as a strong advocacy of what he pithily designated as the "intellectual factor of production," and I may humbly claim that it is this theme on which I dwelt last year, when I spoke of the necessity for "economy of production."

We are met on all sides by falling values, and it appears as if it were impossible, except by the operation of the natural laws of supply and demand, to effect any alteration on this side of the account, but there is abundant evidence to show that the other side of the account will respond instantaneously to intelligent, well-directed effort.

Those who are old enough to remember the marine boiler of twenty or twenty-five years ago, and compare it with the structures of to-day, need no further evidence. The exchange from the brute manual labour of that period, to the intelligent operations of to-day, is most striking; not only is work now produced which would have been totally impossible then, but it is procured at comparatively less cost, and the workman himself is raised by the process. Instead of his labour being expended in coarse unintellectual efforts, it is now employed in the intelligent direction of the machine tools of all kinds, which have in so many cases taken the place of the sledge-hammer and the anvil, the hand-drill, and the hammer and chisel.

In no direction is this more evident than in wood-working machinery, which has been enormously improved of late years, and now-a-days, not only is cost reduced, but a mathematical accuracy of parts and a beauty of finish is obtainable, which was beyond our reach formerly. Again, the opportunity has lately been afforded me of visiting a shipyard on the Wear, where, in spite of very great natural difficulties in the site, marked advance has been made in economising the unproductive labour employed in the transport of material and such like matters. Such operations have not been left solely to old custom or to chance, but have been deliberately and intelligently dealt with; the substitution of hydraulic appliances for hand labour has not only materially reduced the cost of production in many important items, but has also much improved the character of the work. I merely quote this instance as an additional support to the arguments I have laid before you, and do not in any way attempt a detailed description of the several novelties and improvements which will indeed be more specially referred to in a paper which will be read to you later in the session.

But the advances which have been made in this direction, and of which the foregoing are merely a few typical examples, ought not to content us; they should rather act as an incentive to further studies in the same direction, to further working out and experimenting in the many similar fields still untrodden that lie to our hand, any one of which will, like the orchard in the fable, repay the necessary labour if it be only honest and thorough. Let us not be satisfied that because a process, or design, or mode of manufacture has served us well in the past, that, therefore, it is good enough for to-day, still less that it will meet the requirements and competition of to-morrow; and though we should make sure of each single step as we progress, let us not be content short of perfection, or, as George Herbert puts it—

> "Sink not in spirit; who aimeth at the sky
> Shoots higher, much, than he who means a tree."

Could the urgent necessity for such investigation, and the pressing need compelling us boldly and manfully to gird ourselves to the task of collective and individual improvement, be brought home to each and all of us more forcibly than has been done by two simple unadorned statements which have within the last week appeared in our daily papers, if we had only eyes to read and appreciation to realise them? Mr. Price, speaking at Jarrow the other day, gives to us the simple fact, that at this moment vessels-of-war can be built at the northern ports of Europe at prices which, leaving a fair profit to the foreign capitalist, are nevertheless below the actual cost price of similar vessels at Jarrow.

Do you realise what this means? That we have it on unquestionable and high authority that, notwithstanding the extra cost of material, our foreign competitors, whether by reason of cheaper labour or better technical skill on the part of their officials, or by better organisation, either by all these combined or by one singly, are passing us in the race for work of this special description; and, as Mr. Price pointedly observes, if the information conveyed to him refer only at present to vessels-of-war, the step is but a short one to those vessels of peace with which we in this district are more particularly connected, and that the greatest efforts are successfully being made to overtake us in this department also, is within the personal knowledge of many in this room.

But, strangely, this statement is most remarkably borne out by a report of the Societé John Cockerill, which was given in the *Chronicle*. This magnificent establishment employs 10,315 persons, has turned over work during the year ending June last amounting to no less than £1,472,396, and though the resulting profit does not, perhaps, seem to our minds to be excessive, still it is substantial. But there follows another statement to my mind most noteworthy. Whereas the work in hand on June 30th amounted to £314,400, at the end of September it was £400,000. We do not, of course, know precisely what is here meant by these words, "work in hand," but it is evident that whereas during the last two months, we in this country see daily records of iron works closed and shipyards empty, and employment for our workmen daily diminishing, this great company has received large accessions of trade, and thereby gives us ample proof of vitality and progress.

I can only wish that my eloquence was more powerful, my knowledge greater, and my influence more extensive, to enable me to accentuate these striking facts more fully. It may be asked, What can we do? Firstly, I say let us each strive earnestly to improve that small portion of the production of our beloved country which lies under his own hand; and secondly, I would ask whether this institution cannot now take some definite place in improving the technical education of our own district. The extended efforts and the new departure which is just about to be taken by the College of Physical Science, is known to all of you, and you may have read the correspondence which has recently taken place in public on the subject, and have noticed the desire expressed by a relative of my own (who was one of the earliest promoters of the College), to embrace in the term "engineers" not only those mining engineers in view of whose education the idea of a technical college was first originated, but also the "Marine Engineer and Naval Architect." Cannot we, the members of this Institution, respond in some way to this

appeal, and even in the midst of our own depression, and though the tides be low, show in some slight degree that we *do* recognise the value of high scientific attainments in our daily work, and endeavour to render some slight moral, if not pecuniary support, to this movement, which may be so valuable to ourselves, and still more so to those that come after us?

My simple duty now remains to thank you for your patient attention, to hope that if the views I have expressed have not been wholly adopted by all present—indeed, it is not natural or desirable that they should be—yet that you will believe they are the outcome of some thought, and of such attention as I have been able to bestow on a few of the multitude of interesting questions that spread themselves before our eyes to-day; and I feel that I cannot summarise and condense my hopes and wishes for the future of this institution in any better words than by recalling to you the lines of our great English poet:—

"Men, my brothers, men the workers, ever reaping something new;
That which they have done but earnest of the things that they shall do."

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

THE POSITION OF MARINE ENGINEERS.

To the Editor of The Marine Engineer.

Sir,—I must say I read with pleasure the letter of "An Old Chief" in your November issue, as I was glad to find that there has been a misunderstanding on my part, of what he meant in his letter, but I can assure him that I was not alone in taking the meanings I took from his letter. There are some points in his last on which I feel inclined to make a few remarks, but I don't think any good would be attained by cross-firing amongst those who are apparently of the same opinion. Apologising for trespassing on your space,

I am, yours truly,
A MARINE ENGINEER.

Liverpool, *Nov. 19th*, 1885.

FIRST COMPOUND CONDENSING ENGINES FOR ATLANTIC STEAMERS.

To the Editor of The Marine Engineer.

Sir,—Will you, or some of your correspondents, through your columns, kindly give me the name of the first steamer fitted with compound condensing engines that crossed the Atlantic, also the names of the master and of all the engineers in her during the first trip? and oblige, Yours faithfully,
CAPTAIN ANDERSON.

Kirkcaldy, *Nov. 16th*, 1885.

BOARD OF TRADE RULES FOR CRANK SHAFTS.

To the Editor of The Marine Engineer.

Sir,—Would any of your readers kindly inform me the Board of Trade Rules for crank shafts (steel), cylinders 53 in., 32 in., and 19 in. diameter; stroke, 3 ft; pressure, 150 lbs.; I.H.P. 800. Engines with cylinders, 60 in. and 30 in. diameter; stroke, 3 ft.; pressure, 80 lbs.; I.H.P. 700. Both engines being registered 150 N.H.P., having shafts same diameter.

I am, yours truly,
A MARINE ENGINEER.

Hartlepool, *Nov. 17th*, 1885.

Obituary.

Rankin.—Mr. Daniel Rankin, the senior partner of the firm of Rankin & Blackmore, engineers, Eagle Foundry, Greenock, died on Nov. 6th. Mr. Rankin was well known, and his fame, as one of the most skilful and practical engineers on the Clyde, was more or less famous in every civilised country on the globe. His apprenticeship was served with the old-established firm of Messrs. Caird & Co., in the old Eagle Foundry of that town; and during the time that he spent in that famous industrial establishment he gave abundant indication of the possession of that inventive faculty which was such a marked feature of his character in after years. He subsequently spent some time at sea, and on returning home, in the year 1851, he was appointed leading foreman to Messrs. Denny & Co., Dumbarton, who had lately started that marine engineering business which has since grown into one of the most important concerns of the kind on the Clyde. A few years afterwards he entered upon the duties of engineer manager to the extensive steam ferry service started between Granton and Burntisland by the North British Railway Co. Later he became manager of the extensive marine boiler works at Lancefield, Glasgow, belonging to Messrs. Robert Napier & Sons; and his next move was to take the management of the engineering works of the old Greenock firm of Messrs. M'Nab & Co.

In 1862 he met with Captain Edward Blackmore, with whom he agreed to enter into partnership. The new firm forthwith purchased the Eagle Foundry in Baker-street, Greenock, which was then in the market, and during the twenty and odd years that that establishment has been occupied by Messrs. Rankin and Blackmore, it has been the scene of a large and successful engineering business.

In recent years the work carried on by the firm has been very much of a special character, being largely the construction of engines for tug steamers, both of the twin-screw and of the paddle types. A number of years ago the deceased successfully worked out the idea of applying the two-cylinder disconnecting principle to compound engines, and many engines on this plan have been built within the past eight or ten years, no small proportion of the vessels supplied being trading steamers. Mr. Rankin worked out the same idea still further, and devised triple expansion engines of the four-cylinder disconnecting type for use in paddle and twin-screw steamers. Our readers have from time to time seen in our pages notices of Messrs. Rankin and Blackmore's marine engines, so that it is scarcely necessary that we should here enter into any detail regarding their structural peculiarities.

Mr. Rankin was sixty-one years of age at his death. He has left a widow and a grown up family, two of his sons being junior partners of the firm.

"The Pride and Glory of the American Navy."—The new ship *Mohican*, the pride and glory of our American naval force, has made her trial trip. She reached her destination at last, which is more than the most sanguine expected her to do. She started from Mare Island Navy Yard in very handsome style, and ploughed the rough waters of San Francisco Bay for at least 10 miles before anything happened to her. Then something was said by the engineer to be "too tight," and consequently it broke. After that her six big boilers made a superhuman effort—such an extraordinary effort that the mercury in the fireroom stood at 150°, and she sped over the wild Pacific at the tremendous rate of 8 knots an hour, which is fully one-third faster than the most celebrated pedestrian can walk. From that extreme limit she ran down to 4 knots, and then the engines were stopped. This time the trouble was with a "crank" pin. She came to anchor for a week at Pichilingue, her engines were again stopped on her way to Acapulco, and there were several further stops between the latter place and Corinto. From Corinto to Panama, however, she did not stop once. This seems incredible, but the fact is vouched for by Commander Day. To make a short story out of a long voyage, she reached Panama before any one of the officers died of old age, and it is confidently asserted that after she has been practically rebuilt she will be a first-class vessel to swing at anchor and overawe the enemy. Long live the *Mohican!*—*New York Herald.*

The *New York Herald* states that the plans and specifications of a proposed system of signals and life-saving and lighthouse stations across the Atlantic have been filed in the Treasury Department at Washington.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of The Marine Engineer *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—Ed. M. E.]

LAUNCHES.—English.

Challenger.—On Saturday, September 26th, Messrs. Cox and Co. launched from their yard at Falmouth a tug and passenger vessel, 89 ft. by 16 ft. 2 in. by 10 ft., named *Challenger*, and built for Swansea owners. She has been fitted by her builders with engines having 16 in. and 30 in. cylinders and 21 in. stroke, and a steel boiler working at a pressure of 85 lb. When on trial, November 7th, her displacement was 116 tons, I.H.P. rather over 260, and speed 11·4 knots.

Cabo Palos.—On October 24th Messrs. Joseph L. Thomson and Sons launched from their shipbuilding yard, North Sands, Sunderland, an iron screw steamer named *Cabo Palos*, built to the order of Messrs. Ybarra & Co., of Seville. The vessel is of the following dimensions, viz.:—Length, 250 ft.; breadth, 35 ft.; depth of hold, 16 ft. 6 in. She is constructed on the longitudinal cellular system, under special survey, to class 100 A in Lloyd's registry. The engines, which are of the triple expansion type of about 700 I.H.P., are being built by Messrs. Blair & Co., Stockton.

Dragoman.—On October 24th there was launched from the Low Walker shipyard of Messrs. Sir W. G. Armstrong, Mitchell, and Co., a steel cargo steamer, of 4,200 tons deadweight carrying capacity, the first of two sister vessels which the builders have in hand for the Bedouin Steam Navigation Company, of Liverpool. The vessel is built to the highest class at Lloyd's, and in some respects is stronger than their rules require. She has a complete double bottom on the cellullar principle, and has numerous watertight bulkheads, to conform to the Admiralty requirements for transport purposes. Immediately after the launch the vessel was taken to the works of the Wallsend Slipway and Engineering Company, to be fitted with triple expansion engines capable of indicating 1,600 H.P.

Fulwood.—On October 24th there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt & Co., at Southampton, an iron sailing ship of 2,150 tons nett register, and of the following dimensions:—Length (extreme), about 280 feet; breadth (extreme), about 40 ft. 6 in.; depth of hold, about 24 ft. 8 in. The vessel is to the order of Messrs. R. W. Leyland & Co., of Liverpool, and exceeds the highest requirements of both Lloyd's and Liverpool Underwriters' Registry. She is full-rigged and fitted with skysail on mainmast. Ample accommodation is provided in full poop for captain and officers, whilst the petty officers and crew are berthed in large iron deck-house amidships. She is fitted with Harfield's patent combined capstan windlass for working anchors and chains. During construction she has been under the superintendence of Captain Charles Semple, nautical assessor, of Liverpool. The vessel on leaving the ways was christened the *Fulwood* by Miss Stephen.

Roumelia.—On October 26th Messrs. W. Gray & Co. launched from their yard a fine screw steamer of the following dimensions:—285 ft. by 37 ft. 2 in. by 21 ft. 8 in., moulded, to carry over 3,000 tons, built of steel, to class 100 A1 at Lloyd's. The vessel is of the well-decked type, having the long bridge introduced by this firm, and all modern improvements for working ship and cargo. The engines, which are of the three cylinder triple expansion principle, are being supplied by the Central Marine Engineering Company, West Hartlepool, to develop 900 I.H.P., and drive the ship 9½ knots per hour on a daily consumption of 10 tons of coal. The vessel was named *Roumelia* by Mr. Langstaff, of the firm of Langstaff, Ehrenberg & Pollak, of Havre. The steamer is fitted with Emerson, Walker, & Thompson Bros., Limited, patent combination windlass.

Indore.—On November 7th Messrs. Richardson, Duck & Co. launched from their building yard a large iron sailing vessel of the following dimensions:—Length over all, 293 ft.; breadth, extreme, 40 ft. 9 in.; depth in hold, 24 ft. 10 in.; tonnage gross, about, 2,130 tons. This vessel, which has been built to the order of Messrs. Eyre, Evans & Co., Liverpool, is classed 100 A1 in Lloyd's Registry, under special survey. She has a full poop for the accommodation of passengers, captain and officers; a top-gallant-forecastle, fitted with store-rooms, and a deck-house amidships, with accommodation for crew, petty-officers, and steam winch. She will be rigged as a ship, with double top-gallant yards. As the vessel was leaving the ways she was gracefully christened the *Indore* by Miss Bryson, of Claughton, Birkenhead.

Flying Fish.—On November 7th there was launched from the building yard of Mr. J. T. Eltringham, Stone Quay, South Shields, an iron paddle-tug, the dimensions being 122 by 20·3 by 11. The vessel is of the most modern and improved type, and, in addition to the usual requirements for towing purposes, is especially designed for salvage work, having a large hold for the conveyance of steam pumps and salvage machinery to wrecked vessels. She will be fitted with a side-lever, surface condensing engine of 98 N.H.P., steam for which is supplied by two steel multitubular boilers working at 45 lbs. pressure, the paddle-wheel being on the feathering principle. The vessel, which is named the *Flying Fish*, has been built to the order of Messrs. J. P. Rennoldson & Sons, South Shields, who will supply the machinery, and is intended for the towing trade on the Clyde, her owners being the Clyde Shipping Co., of Glasgow and Greenock. The *Flying Fish* is the twenty-ninth vessel supplied to this company by Messrs. Rennoldson.

Witham and Holland.—On November 12th Messrs. Earle's Shipbuilding and Engineering Company, Limited, launched from their yard at Hull, two iron screw fishing cutters, built by them for the Boston Deep Sea Fishing and Ice Company, Limited, and are the first of eight vessels now being constructed for the Boston Company. Their dimensions are—100 ft. by 20 ft. by 10 ft. 6 in., with raised quarter-deck aft and half forecastle forward. They are built to Lloyd's 100 A1 class, and have extra strength at the sides for protection against chafing, to which these vessels are so much exposed. The engines and boiler are placed aft, and the space between these and the forecastle deck is wholly utilised for fish and ice room. The accommodation for captain and officers is under the quarter-deck, and that of the crew under the forecastle. The engine and boiler hatches are enclosed by strong casings, entirely of iron, with a view to making this part additionally secure in bad weather. They will be fitted by the builders with their triple compound three-crank engines, having cylinders 11½ ins., 17 ins., and 30 ins. diameter by 21 ins. stroke, which will be supplied with steam of 150 lbs. pressure from a steel boiler, fitted with two Fox's corrugated furnaces. A powerful steam winch of Earle's special design and make will be fixed on their deck for working the trawl gear and adapted also for taking the anchor on board. The vessels have good lines and sheer, and present a handsome appearance on the water, and are expected to prove themselves in many respects a decided improvement on former vessels built for this purpose.

Brentford.—On Saturday, November 21st, Messrs. W. Gray and Co. launched from their yard at West Hartlepool a fine screw steamer of the following dimensions: 285 ft. by 37 ft. 2 in. by 21 ft. 8 in. moulded, to carry about 3,000 tons, built of steel, to the order of Messrs. Watts, Ward & Co., London and Newcastle, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type, with poops aft, containing handsome saloon and cabins for officers and a few passengers, long raised quarter-deck connected to bridge amidships, the latter being carried over the machinery space, coal bunkers and main hatch right forward of the foremast, thus covering in the lowest part of the vessel and adding greatly to her strength and stability. The crew are housed in the fore part of this extended bridge which will add much to their comfort. The usual topgallant forecastle is fitted forward with Emerson, Walker & Co.'s patent combination capstan windlass. She has five hatches, two steam winches, two donkey boilers, and water ballast in double bottom under each hold and is in every respect well equipped for general trading. The engines, which are on the three cylinder triple expansion principle, are being supplied by Messrs. Blair & Co., Stockton-on-Tees. The christening ceremony was gracefully performed by Mrs. Watson Munroe, Hartburn, near Stockton-on-Tees, the vessel being named *Brentford*. The vessel and machinery have been superintended during construction by Captain Hodgson and Mr. Alchin, on behalf of the owners.

It may be added that the s.s. *Willesden*, a sister ship, launched by this firm for the same owners in May last, has been found to suit admirably, carrying over 3,000 tons at a speed of nine knots an hour, on a consumption of 10 tons of coal per day.

Coot.—On Tuesday, November 24th, Messrs. W. Gray & Co. launched from their yard a handsomely modelled screw steamer of the following dimensions:—280 ft. by 37 ft. by 18 ft. 6 in., to carry about 2,650 tons, built of steel, to the order of the Cork Steamship Company, Cork, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type, with poop aft containing handsome saloon and cabins for officers and a few passengers. Long raised quarter deck connected to a long bridge which is carried forward of the foremast and accommodates the crew. The usual topgallant forecastle is fitted forward with Clark, Chapman, and Co.'s patent combination capstan windlass. This vessel is extra strong, having an iron lower deck additional. She has four hatches, four steam winches, donkey boiler and water ballast in double bottom under each hold, and is in every respect well equipped for general trading. The engines are of the triple expansion type manufactured by the Central Marine Engineering Company, of West Hartlepool. The cylinders are 19½ in., 32½ in., and 53 in. diameter respectively, and the stroke 36 in. The description of engines, &c., is substantially the same as was given for those of the s.s. *Enfield*, and which are doing remarkably well. The christening ceremony was gracefully performed by Mrs. Mudd, Greenfield House, Hartlepool, the vessel being named *Coot*. The vessel and machinery have been superintended during construction by Captain Croft, assisted by Mr. Anderson, on behalf of the owners.

LAUNCHES—Scotch.

King Malcolm.—On October 22nd there was launched from the yard of Mr. W. B. Thompson, at Whiteinch, an iron sailing barque, named *King Malcolm*. The *King Malcolm* is 228 ft. long, 26½ ft. broad, and 21 ft. deep, with a gross tonnage of 1,300 tons. She has been fitted with all the latest and most improved appliances for loading and discharging cargo, including one of Emerson, Walker, & Thompson Bros., Limited, patent capstan windlass, and is finished in a high style of workmanship. She has been built to the order of Messrs. Walker, Govan & Co., of Glasgow, and is the pioneer vessel of what is indended to be a fleet of "King" sailing ships. The christening ceremony was performed by Miss F. King, daughter of Provost King, Hillhead. The *King Malcolm* has been chartered by Messrs. Aitken, Lilburn and Co., and will be placed on their Sydney berth.

Waverley.—On October 24th Messrs. Russell & Co. launched from their shipbuilding yard, at Kingston, Port Glasgow, an iron sailing vessel of 1,108 tons, and of the following dimensions:—Length, 215 ft.; breadth, 35 ft. 2 in.; and depth of hold, 21 ft. 3 in. The vessel, which was built to the order of Messrs. Russell and Pinkerton, shipowners, Glasgow, on leaving the ways, was named the *Waverley*. She is fitted with Emerson, Walker and Thompson Bros., Limited, patent capstan windlass and was built under the superintendence of Captain Smith, who is to command her in the East Indian trade.

Orellana.—On October 26th Messrs. John Reid & Co. launched from their shipbuilding-yard at Port Glasgow, a steel barque of the following dimensions:—Length 208 ft. 7 in.; breadth, 33 ft. 6 in.; depth of hold, 21 ft. 3 in. She is a vessel of about 900 tons nett register, and is classed A 1 at Lloyds. On leaving the ways she was named the *Orellana* by Miss Lura Steele, of Greenock. She has been built to the order of Messrs. Nicholson and M'Gill, shipowners, Liverpool, and is the eleventh vessel built by the Messrs. Reid for that firm. After completion she will proceed to Glasgow, there to load for Brisbane. The *Orellana* will be commanded by Captain Scott, late of the *Dundonald*.

Soochow.—On October 27th Messrs. Scott & Co., shipbuilders, Greenock, launched from their yard a steel screw steamer named the *Soochow*, of 1,600 tons register, and of the following dimensions:—Length, 260 ft.; breadth, 33 ft.; and depth, 23 ft. 6 in. She will be supplied by the builders with compound engines of 200 N.H.P., the diameter of the cylinders being 29 in. and 58 in. respectively, with a piston stroke of 42 in. The new steamer has been built to the order of the China Navigation Company (Limited), and is intended for the coasting trade there.

Battle Isle.—On October 27th there was launched from the shipbuilding yard of Messrs. Scott & Co., at Bowling, an iron screw steamer of the following dimensions:—125 ft. by 20 ft. by 9 ft. 6 in., built to the order of Messrs. Hay, Tarbert, and intended for the Lochfyne herring trade. The vessel has been built to class 100 A1 at Lloyd's under special survey, and is fitted with all the latest improvements, including steam windlass. Compound surface-condensing engines of 68 H.P. will be fitted on board by Messrs. William King & Co., Glasgow. On moving down the ways the ceremony of naming the vessel the *Battle Isle* was performed by Miss Hay, of Tarbert. This is the fifth steamer built by the Messrs. Scott & Co., for the fish trade, and the third launched by them this year for the same trade. Immediately after the launch the *Battle Isle* was towed to Glasgow, where her machinery will be put on board.

Celtic Chief.—On October 27th Messrs. A. M'Millan & Son launched from their dockyard, Dumbarton, the iron sailing ship *Celtic Chief*, of 1,800 tons. This ship has been built to the order of Messrs. Parry, Jones & Co., shipowners, Liverpool, and is to form one of their fleet of East India and San Francisco traders. The *Celtic Chief* is built to class the highest mark at Lloyd's, and many parts of her scantlings exceed considerably the requirements of that body. She is being furnished and outfitted in all respects with a view to the economy of labour on board. The ceremony of naming was performed by Miss Gertrude M'Lellan, Dumbarton.

Avoca.—On October 28th Messrs. Russell & Co., shipbuilders, Greenock, launched from their yard, a first-class iron sailing ship of about 1,600 tons, built to the order of Mr. James Nourse, London, and of the following dimensions:—Length, 260 ft.; breadth, 38 ft.; and depth of hold, 23 ft. She is fitted with Emerson, Walker and Thompson Brothers', Limited, patent capstan windlass.

Dee.—On October 29th Messrs. Russell & Co. launched from their east end yard at Port Glasgow, an iron sailing bark, named *Dee*, of 1,120 tons net register, and of the following principal dimensions:—Length, 215 ft.; breadth, 35 ft.; depth of hold, 21 ft. 3 in. She is fitted with Emerson, Walker and Thompson Brothers', Limited, patent capstan windlass. This vessel has been built to the order of Captain M'Farlane, Glenclune.

Bengal.—On November 6th a new P. and O steamer named the *Bengal*, was launched from the yard of Messrs. Caird & Co., Greenock. The *Bengal* is a duplicate of the *Coromandel*, the steamer which preceded her, and which was the first belonging to the company to be fitted with triple expansion engines. In accordance with this principle the *Bengal* will have inverted direct-acting compound triple expansion engines, with three cylinders and three double-ended boilers, and a working pressure of 140 lbs. steam and 3,200 I.H.P. The principal dimensions of the *Bengal* are:—Length, 400 ft.; breadth, 45 ft.; depth of hold, 31 ft. 9 in.; displacement on a draught of 25 ft., 8,800; deadweight capacity, 4,200 tons. The ceremony of naming the steamer was performed by Mrs. Harry Smith, wife of ex-sheriff Smith.

Knight of St. Patrick.—On Nov. 6th the Grangemouth Dockyard Company successfully launched a handsomely modelled twin-screw steamer named *Knight of St. Patrick*. This vessel is built to the order of Dunsmuir & Jackson, Govan, Glasgow, for Messrs. J. Prendeville & Co., Liverpool. Her dimensions are as follows:—Length between perpendiculars, 146 ft.; breadth, 22 ft. 7 in.; depth, moulded, 13 ft.; depth of hold, 12 ft. 6 in. She is constructed of the best mild steel, made by the Steel Company, of Scotland (Siemens-Martin process). This handsome vessel is specially adapted for towing and salvage purposes on the Mersey, also as a passenger tender. She has a first-class passenger certificate, is built to the Board of Trade requirements, and will be placed on the Admiralty list. The vessel, on leaving the ways, was gracefully named *Knight of St. Patrick* by Miss Prendeville, daughter of the managing director. The vessel will be towed to Leith to receive her engines and boilers, which are being supplied by Messrs. Dunsmuir & Jackson. She is to be fitted with two sets of very powerful engines, working at a pressure of 110 lb. per square inch, and is expected to attain a high rate of speed. The vessel has been designed by, and both the hull and machinery have been constructed under the personal superintendence of Mr. James Taylor, 60, Castle-street, Liverpool, the consulting engineer and naval architect to the company.

Dundee.—On November 7th there was launched at Dundee, by Messrs. Gourlay Brothers & Co., a steel steamer of 1,400 tons gross register, named the *Dundee*, for the Dundee, Perth and London Shipping Company. Her dimensions are:—Length, 270 ft.; breadth, 34 ft. 1 in.; and depth of hold, 17 ft. 3½ in. She will be engined by the builders with three cylinder engines

of 320 N.H.P. She will also be fitted up with the electric light, and her cabins have been fitted up with berths for 125 first and second class passengers. The *Dundee* will be engaged in the Dundee and London trade.

Sarah.—On November 7th there was launched from the building-yard of Messrs. A. Hall & Co., Aberdeen, a screw steamer which has been built to the order of Messrs. William Mollison & Sons, merchants, Bervie and Gourdon. The launching ceremony was performed by Miss J. R. Mollison, daughter of the senior partner of the firm, who christened her *Sarah*. The dimensions of the steamer are as follows:—Length, 90 ft. over all; beam, 18¼ ft.; depth of hold, 10 ft. She is fitted up with surface-condensing engines, built by Messrs. Hall, Russell & Co., Aberdeen, and has a N.H.P. of 35. The *Sarah* is intended for the coast trade in coals, grain, &c., carried on by her owners, and she will be registered at the port of Montrose.

Lahore.—On November 9th Messrs. William Denny and Brothers, Dumbarton, launched a steel screw steamer named the *Lahore*, a vessel of 3,270 tons gross register, and measuring 340 ft. by 42 ft. by 29 ft. Her engines, which will be supplied by Messrs. Denny & Co., are constructed on the quadruple-expansion principle, and are of about 2,000 I.H.P.

Matabele.—On November 10th there was successfully launched, in the presence of the owner and numerous friends, the s.s. *Matabele*, built to the order of Messrs. John T. Rennie, Son, & Co., of London and Aberdeen, by Messrs. Hall, Russell & Co., of the latter city. This vessel is 252 ft. long, 35 ft. 3 in. beam by 23 ft. depth of hold, and is built on the spar-deck rule, with long bridge deck amidships, having a very handsome appearance in the water. She is fitted with all modern improvements, including direct-acting steam windlass and winches exhausting into stokehold, steam-steering gear, &c. The engines, by the same builders, are on the triplex-expansion system, with cylinders 19 in., 30 in., and 50 in., with a stroke of 36 in. Steam is supplied by two entirely steel boilers 11 ft. 9 in. diameter by 9 ft. 6 in. long, each fitted with three of Fox's corrugated furnaces, and working at 150 lb. pressure, the engines and boilers being under the superintendence of Messrs. Flanney and Baggallay, London and Liverpool, during construction. She is intended for the owners Direct Natal Line.

Maule.—On November 11th Messrs. John Reid & Co. launched from their shipbuilding yard at Port Glasgow, a screw steamer of 325 tons, built to the order of Compania Sud-Americana de Vapores, to the specification and under the supervision of Mr. Thomas Dewsbury, Leeds. Engines are being supplied by Messrs. Kincaid & Co., Greenock. The new steamer was named the *Maule*, and is the eighth vessel built by Messrs. Reid for the same company.

Circé.—On November 11th Messrs. Alex. Stephen & Sons, Linthouse, Govan, launched a beautifully-modelled iron sailing ship, of about 1,650 tons, built to the order of Mr. A. C. le Quellec, Bordeaux, and, while suitable for general trade, specially intended for carrying nitrates. She is fitted with all the most recent and improved appliances for working the ship and handling the cargo, and from her fine lines and handsome appearance will no doubt prove a fast sailer. The ship was named the *Circé* by Miss Stewart, daughter of Rev. Dr. Stewart, Lovedale, South Africa, and she is the sixth vessel built by the Messrs. Stephen for Mr. le Quellec, to whose line she will prove a note-worthy addition.

Euphrosyne.—On November 12th Messrs. Robert Duncan and Co., Port Glasgow, launched from their shipbuilding yard a steel sailing ship, of 1,800 tons nett register. Dimensions:—260 ft. by 40 ft. by 23 ft. 8 in.; built to the order of Mr. Colin S. Caird, Greenock, for whom Messrs. Duncan & Co., have already built several first-class clipper ships. This ship has been built to the highest order in Lloyd's and Liverpool registries, and is fitted with two steam winches, donkey boiler, condenser, and all the most modern improvements for the efficient working of such a large sailing ship. During construction she was superintended by Mr. James M'Ewan, Greenock. On leaving the ways she was named *Euphrosyne* by Miss Lizzie Duncan, and immediately towed to the harbour to receive her masts.

Fulmar.—On November 21st, Messrs. J. M'Kenzie & Co., boatbuilders, Leith, launched from their yard a wooden steam fishing vessel, named the *Fulmar*, built to the order of Mr. J. L. Cunliffe, Edinburgh. The dimensions are:—Length (between perpendiculars), 67 ft.; breadth, 17 ft.; depth, 8 ft. 9 in. The vessel, which is intended for the net and line deep sea fishing, will be supplied with engines by Messrs. John Cran & Co., Leith. At present eight of these vessels have been contracted for, and several of them are already on the stocks in the various ship-building yards.

LAUNCHES—Irish.

George B. Balfour.—On October 27th a three-mast schooner was launched from the shipbuilding yard of Mr. Paul Rodgers, at Carrickfergus. The vessel was named the *George B. Balfour*, and has been built to the order of Messrs. James Fisher & Sons, of Barrow-in-Furness. Her dimensions are:—Length, 125 ft.; breadth, 24 ft.; and depth, 10 ft. Her frames are of iron, and the plating of steel. She has been built under special survey, and will be classed 100 A 1 at Lloyd's. The ceremony of christening was performed by Mrs. Lynn. The *George B. Balfour* will be fitted out under the superintendence of Captain Henry Watkinson, and when finished will be engaged in the foreign trade.

Polly Woodside.—On November 7th Messrs. Workman, Clark & Co. (Limited) launched from their shipbuilding yard at Belfast, a barque for Mr. W. J. Woodside, of Belfast. The dimensions of the vessel are:—Length between perpendiculars, 185 ft.; breadth, 30 ft.; depth of hold, 16 ft. The capacity for deadweight is to be 1,000 tons on Lloyd's freeboard. The ceremony of christening the vessel the *Polly Woodside* was performed by Mrs. Woodside, the wife of the owner. It is intended that the barque will be principally employed in the River Plate trade, for which she will be ready in a few weeks.

Optic.—On November 12th there was launched from the shipbuilding yard of Messrs. Harland & Wolff, Belfast, the above-named steamer for the Belfast Steamship Company (Limited). She is a sister ship to the *Caloric*, and her principal dimensions are:—Length, 243 ft.; breadth, 31 ft. 6 in.; and depth of hold, 15 ft. 3 in. This vessel, which is designed and built for the Belfast and Liverpool trade, is fitted up with all the most recent improvements. Both ships are being fitted up with the electric light in all parts from bow to stern.

LAUNCH.—Russian.

Admiral Nakhimoff.—This new belted cruiser was successfully launched on November 2nd from the yard of the Baltic Works, St. Petersburg, in the presence of the Emperor and Empress, who afterwards assisted at the consecration of the new fast torpedo boat, just laid down at the same works. The *Admiral Nakhimoff* is 333 ft. long, 7,781 tonnage, with engines of 8,000 H.P., covered with plates from 8 to 10 in. thick, and armed with eight 9 in. and ten 6 in. rifled guns.

LAUNCH.—Danish.

Jarl.—On November 5th there was launched by the Elsinore Iron Shipbuilding and Engineering Company, of Denmark, a passenger steamer named *Jarl*, built of steel to the order of the Oest Bornholmske Steam Navigation Company. Her dimensions are:—Length, 133 ft. 6 in.; breadth, 21 ft. 6 in.; and depth, 16 ft. 6 in.; and has compound engines of 480 I.H.P. The guaranteed speed is 12 knots per hour.

LAUNCH.—German.

Mowe.—The sixth iron sailing vessel in the yard of the Schiff- und Maschinenbau Actien Gelleschaft Germania, has lately been successfully launched. It has been built for the North German Steamship Company, its name being *Mowe*. The length is 236 ft., breadth, 44 ft. 9 in., the registered tonnage is 1,650 tons, the vessel being a barque. The equipment is all on a handsome scale. The *Mowe* carries a large boat, a shallop, a gig and a jolly boat. The Vulcan Company have begun the building of the steamships required for the subsidised services by the North German Lloyd. They are to be large vessels of a very superior class.

TRIAL TRIPS.

Heliades.—The new steamer *Heliades*, the latest addition to the Houston Line of steamers between Liverpool and the River Plate, has had a successful trial trip, and returned to Hartlepool to take in her bunker coal. The *Heliades*, which has been built by Messrs. Richardson, Duck & Co., of Stockton, is a very fine vessel, of 1,921 tons nett register, with spar deck, and all the

latest appliances and improvements, including Sir William Thompson's compasses, Harrison's steam steering-gear, Blake's donkey boiler, of 150 lb. working pressure, &c. This is the first boiler of this description which has been made for such a high pressure, but it has been turned out in the most satisfactory manner, and to the entire approval of the Board of Trade and Lloyd's surveyors.

Leven.—On October 21st the twin screw patent hopper dredger *Leven*, constructed by W. Simons & Co., Renfrew, for the Dumbarton Harbour Board, successfully underwent a series of official trials at Dumbarton. This vessel was ordered in November last, to effect important improvements in the Leven, after considerable inquiries as to the best type of dredger adapted for that purpose. We give the following interesting particulars:—Length on deck, 191ft.; breadth, moulded, 38½ft.; depth, moulded, 15ft. The hoppers are placed near the centre of the vessel, and have capacity for 800 tons of its own dredgings. The vessel is built principally of steel, and is subdivided into ten watertight compartments, which enables it to keep afloat in the event of any of the compartments being injured. Cabins for officers and crew are placed on each side of well. They are very commodious and comfortably fitted up, and are efficiently heated by means of copper pipes. Steam steering gear, supplied by Messrs. Muir & Caldwell, Glasgow, is fitted up admidships, the steering engine being controlled from a lookout bridge erected on top of the main framing, which gives the steersman a clear view ahead of the vessel. The bucket ladder is fixed on the builders' patent traversing carriage, which enables the buckets to dredge in advance of the bow, and can be afterwards brought back and housed on deck, so as not to impede the vessel's sailing qualities. This arrangement will be found of great advantage, as the vessel, instead of lying idle until the tide makes—as is often the case at other ports—will be able to excavate into banks ahead of itself, and so practically cuts its own flotation. It can also dredge to a depth of 32 feet below the light water line. The engines are compound surface condensing, and consist of two pairs of 800 I.H.P., collectively. The boilers are of steel, constructed for a working pressure of 90 lb. per square inch, all in accordance with Board of Trade and Lloyd's requirements. The main gearing for driving the bucket ladder is chiefly of steel, which for this purpose is much superior to cast iron, and greatly reduces the tear and wear in these parts. A separate hoisting engine is fitted up in forward end of vessel for controlling the bucket ladder. Powerful crab winches are placed at bow and stern for working the vessel. They are of a special design, and are particularly well adapted for the work required. They are triple geared, and have three separate barrels, fitted so that each mooring chain can be worked independently, also warping ends for use at quays, &c. The buckets are made of steel, and have a capacity of 17 cubic feet, and are driven at the rate of twenty per minute, and when working in sand raise the enormous quantity of 800 tons per hour. After loading the hoppers, the vessel steamed to the measured mile at Wemyss Bay, where a trial of its speed took place, and after four consecutive runs a mean speed of fully 9½ miles was attained, which was considered very satisfactory. The builders have used every means to make this vessel fully equal to any of the most recent hopper dredgers they have constructed, and from the results obtained on October 21st the *Leven* will doubtless perform its work to the entire satisfaction of all concerned. Similar vessels to the above for Belfast Harbour Commissioners and the Royal Danish Government are in course of construction by W. Simons and Co.

Norden.—On October 24th the new screw steamer *Norden*, recently launched from the shipbuilding yard of Messrs. Boolds, Sharer & Co., Pallion, and built to the order of the Svenska Lloyd's, Gothenburg, had her trial trip at sea. Having stipulated that the vessel should carry a certain dead weight with Lloyd's new freeboard, she was loaded and found to do so. In this loaded condition she put out to sea for trial. After the compasses had been adjusted the *Norden* was run to Hartlepool and back without stopping, and in spite of the heavy sea running the results obtained were highly satisfactory. The deadweight trim when loaded, speed, and consumption of coal per day were all guaranteed, and the result of each when proved was as desired. The vessel is supplied with a horizontal donkey boiler; steam winches and windlass by Messrs. Clarke, Chapman & Parsons, of Gateshead; midship steering gear and after screw gear by Messrs. John Lynn & Co., of Pallion; and fire engines by Messrs. J. Stone and Co., London. The engines, which are from the works of Messrs. Carr & Co., Limited, are of the direct acting compound surface-condensing type, having cylinders 27 in. and 50 in. diameter, with a stroke of 36 in., and extra large steel boiler. After the trip, the *Norden* left for Gothenburg to take up her station. She has been specially constructed and arranged for the company's cargo and passenger trade between Hamburg and Gothenburg.

Saltees.—On October 24th this steamer, built and engined by Messrs. D. & W. Henderson, Partick, for the Clyde Shipping Co., had a successful official trial of speed on the measured mile. The new steamer is intended to keep up the company's connection between Belfast, Dublin, Waterford, and Cork, and thereby accelerate the passages of the steamers between Glasgow and Cork, and is of the following dimensions:—Length, 186 ft.; breadth of beam, 28 ft.; and depth of hold, 14 ft.; while her tonnage is 576 gross. She is propelled by a pair of engines, the cylinders being 25 in. and 50 in. in diameter, the stroke being 36 in. A speed of about 11¾ knots was obtained.

William Jolliffe.—On October 26th the new screw tug, *William Jolliffe*, of Liverpool, was taken on her trial trip at sea. The boat has been built to the order of Mr. T. A. Jolliffe by Messrs. John Readhead & Co., West Docks, South Shields, and is a duplicate of the *William Jolliffe* built by the same firm a few months ago, and which was purchased by the Government and converted into a gunboat now named the *Woodcock*. The *William Jolliffe* is of the following dimensions, viz., 149 ft. by 26 ft. 2 in. by 14 ft., and is fitted with compound surface-condensing engines of 250 N.H.P. and two steel boilers, steam to windlass, Higginson's quartermaster steering apparatus. She is also fitted for water ballast for trimming purposes. On the trial trip she attained a speed of 14 knots. She has been built under the superintendence of Mr. Thomas Grant, of Liverpool.

Screw Steamer.—On October 29th a screw steamer, 45 ft. long by 9 ft. beam by 4 ft. draught, built to the order of a firm of Hamburg merchants for their West Coast of Africa trade, by Mr. William Dickinson, of Birkenhead, performed her trial trip. The machinery was supplied by Messrs. Jens Jensen & Co., Birkenhead. The engines worked very smoothly and propelled the boat about 10 knots per hour. The total weight of the engines is only about 6½ cwt. and they are contained within two feet square.

Captain M'Clure.—On October 29th the screw steamer *Captain M'Clure*, recently built by Messrs. Murdoch & Murray, Port Glasgow, had her official trial trip. On the measured mile she attained a speed of 12¾ knots per hour, which was considered very satisfactory. Messrs. J. & T. Young, Ayr, supplied the engines.

Stormcock.—On October 31st the new twin screw tug *Stormcock*, of 482 tons O.M. and 1,200 I.H.P., just completed by Messrs. Laird Brothers for the Liverpool Screw Towing and Lighterage Company, went out for her official trial trip, the result of which was entirely satisfactory to representatives of the owners who were on board. The engines worked up to their full power without the slightest hitch, and the vessel attained a speed of nearly 13 knots an hour, in spite of rough weather and a heavy sea.

Lamberton and Bonito.—On November 3rd the two steam trawlers, *Lamberton* and *Bonito*, recently launched from the Caledon shipyard of Mr. W. B. Thompson, of Glasgow and Dundee, went down the river for the purpose of testing the comparative merits of the ordinary two-cylinder compound engines with which the *Lamberton* is fitted, and the triple expansion three-cylinder engines supplied to the *Bonito*. The engines of the *Bonito* are the first made in Dundee of the triple-expansion type, and present several novel features not found in the ordinary two-cylinder engine, nor in the ordinary three-crank triple expansion engine. Designed and made by Mr. Thompson at the Tay Foundry, they display a remarkable simplicity of construction, having no less than 40 fewer journals to attend to and lubricate than is usual. The valve motion of each cylinder is wrought off a single eccentric in place of the double eccentric and link motion usually fitted. The relative dimensions of the two vessels are:—*Lamberton*, 95 by 19 by 10. with cylinders 17 in. and 34 in. and 24 in. stroke; boiler pressure, 100 lbs.; N.H.P., 45 *Bonito*, 90 by 20 by 9, with three cylinders, 10½ in., 15 in., and 27 in. and 16 in. stroke; boiler pressure, 140 lbs.; N.H.P., 38. The vessels left the dock together shortly before noon, each having previously taken 30 cwt, of Newcastle household coal, carefully weighed into bags for use in getting up steam and during the trial. Both kept close company at the same speed during the trial, and the coal consumed was carefully noted from time to time, diagrams being taken periodically to ascertain the power developed by the engines. On reaching the river mouth the course was laid for the Carr Beacon, where the vessels were turned and steered for St. Andrews, thence to Dundee, which was reached about six, the weather during the trial being favourable for the trip. The

I.H.P. of the *Lamberton*, with a steam pressure of 90 lbs., was 155, the revolutions being 65, and a consumption of coal amounting to 24¼ cwt. from laying fires to the end of the trial trip. The *Bonito* indicated 123 H.P., with a steam pressure of 115 lbs., giving 104 revolutions, and consuming 21¼ cwt. of coal from laying fires to end of trip. The vessels have been fitted out especially for trawling. The main hold is fitted with divisions for carrying fish, and at the fore part a compartment has been arranged for carrying a supply of ice. A steam winch placed abaft the foremast furnishes the necessary power for working the trawl gear, and in the bow is placed a handy windlass for hoisting the anchors. The rig adopted is that of a fore-and-aft schooner, and the spread of canvas is sufficient to handle the vessel without steam. Under the main deck, immediately abaft the engines, is a cabin for the accommodation of captain, mate, and engineers, the seamen being berthed in a forecastle forward. The trawling gear includes trawl beams, nets, dandy, bridles, and the usual lines, chains, &c. The steering gear is placed amidships over the boilers, and gives the steersman a commanding position, being raised some feet above the deck. In addition to being fitted as steam trawlers each vessel is equipped with towing hook and rail, so as to serve when required as a tug boat. Both vessels have been built to Lloyd's rules, and equipped to Board of Trade requirements. The *Lamberton* is for Berwick-on-Tweed owners, and the *Bonito* for the Lowestoft Steam Fishing and Carrying Company.

Palamed.—On November 6th the s.s. *Palamed*, built by Messrs. Andrew Leslie & Co. for the Ocean Steamship Company of Liverpool, was taken on her trial trip. The dimensions of the vessel are as follows:—Length, 320 ft.; breadth, 36 ft.; and depth, 27 ft. 9 in. Her engines, constructed by Messrs. Robert Stephenson & Co., are of the Holt's tandem design, having cylinders 27 in. and 58 in. diameter, with a stroke of 5 ft., and 1,500 I.H.P. Steam is supplied from one large double-ended steel boiler, fitted with Fox's patent corrugated furnaces, weighing 75 tons. The engines worked smoothly and well on the trip, and we are informed, gave the highest satisfaction. Immediately on the adjustment of her compasses the vessel proceeded to Middlesbrough to take in a cargo of iron for Liverpool. This is the first of four similar vessels now being built and engined by the same firm.

Reviews.

The Marine Steam Engine. By R. Sennett, R.N. London: Longmans, Green & Co. *Second Edition.*

In an age in which every day sees our warships tending more and more to become mere large "floating war machines," rather than ships, properly so-called, it not only behoves, but becomes absolutely essential that, all our engineer officers should take every possible opportunity to make themselves thoroughly acquainted with each and all of the multitudinous appliances that go towards making up the "machine," and with their ever increasing responsibility.

That these onerous responsibilities are being steadily added to, and that they involve not only the engineer officers of the ship, but also those officers who have charge of the navigating and fighting of her, would not, we think, for one moment be denied by anyone who has had the opportunity of inspecting a warship of, say only, ten or fifteen years ago, and a similar vessel of to-day. If he be a careful observer he cannot fail but notice the enormous increase in both the number and complexity of the machines carried by the later type of vessel, and it must further occur to him that to handle such a vessel in an efficient manner necessitates on the part of all her officers an amount of training and knowledge that can only be obtained by a close and appreciative application to their profession. The second edition of Mr. Sennett's most valuable work has been brought out with the object of assisting engineer officers in quest of knowledge, regarding the machinery placed in their charge, and also with a view of affording Naval officers generally, a knowledge of the machinery carried by the vessels they may be called upon to command, and to the latter we specially commend the work, as the descriptions therein contained of the various auxiliary engines and fittings that come under their more immediate control, such as steering engines and gear, turret turning engines, capstan engines, &c., are clearly and lucidly written; illustrations being supplied to aid the description where necessary.

To our engineer readers we need only mention that in compiling the present edition the author's labours have been directed not so much towards the revision of the previous edition, but rather to bringing the work up to date by supplying information relating to the more recent developments of marine engineering, and more especially is this noticeable with reference to triple expansion engines and closed stoke-holds with forced draughts, which are now becoming so generally adopted for war ships.

Perhaps, however, the class of readers, from a numerical point of view, to whom the work will prove most valuable will be the large body of engineer students preparing for appointments, whether it be in Her Majesty's service or in the mercantile marine, and to all of these we strongly recommend the book, not only on account of its author's lengthy and varied experience in meeting the requirements of engineering students, but also, and chiefly, because of the popular and comprehensive manner in which the author has dealt with his subject, and it would, indeed, be difficult to place before so numerous a class a more suitable or excellent text-book.

By judiciously, though not exclusively, confining himself to the more recent practices pursued in marine engineering, and by carefully avoiding, as far as possible, the use of mathematical expressions, the author has succeeded in producing a work which is happily characterised by being neither too general in scope nor too theoretical in character.

From a reader's point of view the book leaves nothing to be desired. It is well and clearly printed on a good paper, enclosed in a strong, neat binding, and possesses the additional merits of being carefully *indexed and amply illustrated.*

Miscellaneous.

A Russian semi-official journal announced that after the launch of the cruiser *Admiral Nachimoff*, an ironclad, on the model of the British armour-plated barbette ship *Imperieuse*, was laid down on the same stocks.

The *Devastation* has had her bunkers ventilated upon a new principle, and has been fitted with dished torpedo ports for the purpose of keeping out the water.

Friction and Lubricants.—At the meeting of the Liverpool Engineering Society, held on October 28th, a paper by Professor Hele-Shaw (University College, Liverpool), entitled, "Recent Researches on the Nature of Friction and the Action of Lubricants," was read by the author. The author briefly reviewed the steps which had been made in the progress of our knowledge of friction, and pointed out that General Morin's results and conclusions, both on the sliding and rolling contact of surfaces, published between 1830 and 1834, had until recent years been regarded as final. During the last ten years, however, many scientific men had worked at the subject, and much light had been thrown, not only on the sliding and rolling friction of solids, but on the friction of liquids and gases. The author in the present paper confined his remarks entirely to the sliding contact of dry and lubricated surfaces of solids. Commencing with the friction of dry surfaces, it has for some time been admitted that the so-called laws of friction usually given in text-books are probably never exactly true under ordinary pressures and velocities, while they lead to very erroneous conclusions if applied beyond moderate limits; and the experiments of Ball, Douglas Galton, and Westinghouse, Fleeming Jenkin and Ewing, Poirée, and others were alluded to in proof of this. In discussing the actual nature of friction of dry surfaces, the author believed that more careful and elaborate observations of temperature at extreme velocities and pressures were needed. Coming to the subject of the contact of lubricated surfaces, a far greater advance had been made. The work of Thurston, and the experiments made by the committee of the Institution of Mechanical Engineers, were of great value, and the main results were brought forward. A striking feature in the progress of the subject was the increasing use of testing machines, and those of Thurston, Stapper, and Baily were exhibited and described. In conclusion, the author stated that the question of lubricants was of immense importance in marine engineering, and, while large sums of money were being annually saved in railways by scientific lubricant tests, the mode of judging the efficiency of lubricants for marine engines remained of the most crude nature, and this alone in a place like Liverpool was, he trusted, a sufficient reason for bringing forward the present paper.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from October 23rd to November 18th, 1885.

12696 J. S. Sutcliffe and G. Stonehouse. Fuel economisers.
12703 W. P. Strawson. Manufacture of certain kinds of anchors.
12729 R. T. Brankston. Mounting for a quick-firing gun.
12730 A. Noble. Mounting for a quick-firing gun.
12731 R. Penman. Steam boilers.
12743 H. Heaton. Steam boilers.
12747 J. Stewart and F. H. Hallard. Fastening tubes in metal plates for boilers, etc.
12758 A. W. Robinson. Dredger buckets.
12761 J. H. Kidd. Machinery for pumping, raising, and forcing liquids.
12762 J. C. Belfield. Furnace.
12766 C. Moseley. Manufacture of buoyant fabrics.
12774 J. Holland and J. Lever. Engine, piston, pump, and cylinder packing.
12780 Mewburn (J. L. Martiny & Co.). Non-conducting material for covering steam boilers, etc.
12802 H. P. Fenby. Strengthening metallic rings and tubes.
12810 H. J. A. Bowers. Purifying water for steam boilers.
12817 W. Noble and A. Mackie. Furnaces for boilers.
12825 T. D. Hollick. Hydraulic and steam hauling and hoisting apparatus.
12826 T. D. Hollick. Steam and hydraulic steering apparatus.
12828 T. Lockerbie. Furnace bars.
12836 F. Klimsch. Single-acting steam engine.
12837 Imray (H. Dulitz). Explosive compound.
12860 D. McNamara. Speed indicators.
12885 J. Revell. Locks for canals.
12886 L. Vojácek. Propeller-wheels for pumps, etc.
12898 T. A. Topf and Söhne. Fire bar.
12915 J. T. Bucknill. Torpedoes.
12928 S. Melville. Tube stoppers.
12935 J. N. Coxon. Instrument for placing of eccentrics, also for showing the position of valves.
12936 H. J. H. King. Water motor governors.
12940 W. W. Campbell. Steam traps.
12943 M. F. Fitz-Gerald. Regulating the speed of machinery.
12945 J. Oxley. Boiling by steam.
12948 W. Tyzack. Mechanical firing of boiler and other furnaces.
12954 J. Buck. Construction of steam boilers.
12956 Henderson (L. Baron). Rotary lift and force pumps.
12961 E. De Pass (J. F. Rocca-Ziégler & La Société Schwob Frères). Propulsion of torpedo boats, etc.
12963 S. G. Browne and W. Boby. Direct acting steam engines.
12969 W. White. Ball, float, and other valves.
12981 T. A. F. Hall, H. T. Clanchy, and C. H. Dent. Rafts or apparatus for saving life at sea.
12997 A. & C. Stewart. Furnaces for generating steam.
13041 W. C. Carter. Calculating scales for the rivet joints of steam boilers.
13044 Abel (A. C. Nagel, R. H. Kaemp, and A. Linnenbrügge). Hydro-propulsion of vessels.
13048 D. Campbell and G. L. Schultz. Buoys.
13053 T. Nordenfelt. Machine guns and the mounting of same.
13059 T. S. Heffer. Machinery for firing fire-arms.
13063 W. L. Bone. Safety valve.
13064 J. A. Yeadon and R. Middleton. Manufacture of artificial fuel.
13067 J. A. Yeadon and R. Middleton. Manufacture of artificial fuel.
13071 W. Armitage. Smoke burning.
13090 W. Clarke, A. H. Chapman, the Hon. C. A. Parsons, and J. B. Furneaux. Steam generators.
13095 W. A. F. Blakeney. War ships and other vessels.
13116 T. Schiller and P. Brennicke. Steam generators.
13145 C. D. Goubet. Submarine torpedo vessels.
13160 A. Brown. Hopper, collier, and cargo steamer.
13163 Groth (G. Daimler). Oil motive power engines.
13165 L. Griscom. Stub ends for crank-pins, etc.
13182 W. James and G. Crowe. Sight-feed lubricators.
13190 T. Whitaker. Rotary engines.
13192 W. Brock. Packing for piston rods, &c.
13199 C. T. Herbert. Application of feed water heaters to condensing engines.
13206 R. Morris. Adapting breech-loading guns for practice with miniature ammunition.
13249 W. Jarvis. Compound engines for steam, &c.
13250 W. Jarvis. Pumps.
13272 J. W. Holden. Economising fuel and consuming smoke of steam and other boilers.
13278 C. B. Davison. Boiler furnaces.
13290 P. W. Willans. Steam engines.
13295 P. Reilly. Boilers for the generation of steam.
13310 A. Beldam. Packing for stuffing boxes.
13318 J. L. Watson. Driving punkahs.
13329 J. Beresford and W. Restall. Ship's water-closets.
13334 C. F. E. Berg. Ship's course recorder.
13339 S. Butler. Pistons.
13355 A. Barrett. Alarm applicable to steam boilers, &c.
13364 A. P. J. Stourton. Submarine boats.
13370 C. Stout. Slide valves and the means of actuating and lubricating same.
13374 J. H. R. Dinsmore. Rotary motors and pumps.
13391 H. J. H. King. Compound steam engines.
13393 C. S. Madan. Injectors for raising and forcing liquid and feeding steam boilers.
13395 H. H. Sporten. Measuring water.
13396 E. Jackson. Composition for coating ships' bottoms, &c.
13397 J. L. Cantelo. Removing scum, &c., from steam boilers.
13412 J. I. Thornycroft. Transmitting and indicating orders or directions on board vessels.
13421 Lake (J. Allard). Apparatus for removing earth, &c, for use in connection with a dredging machine.
13427 W. Hornsby and R. Edwards. Construction of shaft bearings to allow for boiler expansion.
13430 J. Johnson. Gearing wheels and pinions.
13445 M. W. Household and G. F. Janes. Ejectors.
13447 A. C. Nagel, R. H. Kaemp and A. W. F. G. Linnenbrügge. Driving gear.
13457 G. Anderson. Steam cranes.
13474 F. Bisson and M. Runkel. Repeating guns and rifles.
13480 J. T. Parlour. Dredging, &c.
13482 H. St. G. Wilkinson. Propelling steam ships.
13512 W. Wadsworth. Rotary pumps and engines.
13524 W. Foulis. Heating ships' cabins, &c.
13540 E. P. Plenty. Return tube boilers.
13543 J. K. Rogers. Application of the electric search light to a gun or cannon.
13544 J. T. Bucknill. Marine engines for driving vessels with twin screws.
13547 J. M. McMurtrie. Lubricators.
13552 T. Staples. Internal flues, firebox and cross tube for vertical boilers.
13553 T. Staples. Internal flues of horizontal boilers.
13559 R. Yarrow. Protecting ships' ventilators.
13560 R. Walker. Consuming oil as fuel.
13570 M. H. Taylor and L. Benjamin. Propeller apertures of ships.
13580 H. G. Tipping. Lifeboats.
13583 B. H. Remmers and J. Williamson. Tubular heating and cooling or condensing apparatus.
13585 E. Kaselowsky. Motors.
13589 W. Lissons and P. P. White. Arranging the main and mizen sheet blocks for fishing smacks and other vessels.
13596 A. Mackie. Boiler furnaces.
13614 Johnson (V. G. Bell). Rotary motive power engine or pump.
13619 E. Craddock. Measuring water and other liquids.
13623 E. R. Royston. Motive power engines.
13656 B. Law and C. W. Pinkney. Safety governor and alarm sight-feed lubricators.
13669 H. A. Andrews. Lubricators.
13673 W. Kent. Steam boilers.
13680 R. Brown. Vertical steam boilers.
13690 Lake (C. Lamm). Explosive compound.
13701 Edwards (H. Enke). Rotary pumps.
13702 J. T. Bucknill. Firing submarine mines by observation.
13706 T. Nordenfelt. Locomotive torpedoes.
13710 T. A. Arrol and J. Pringle. Reversing gear for motive power engines.
13719 R. Armstrong. Producing circulation in steam boilers.
13735 A. T. Wedelin. Aiming and firing of firearms.
13736 E. Cory. Motive power engines.
13743 J. Gardner. Couplings for screw propeller shafts.
13745 F. W. Gritten. Flexible valves.
13756 M. Neuhaus. Producing a vacuum.

13769 H. Meinecke, jun. Water meters.
13772 J. Wimshurst. Producing high vacua.
13784 Holden, Burnley & Co., and J. Tidswell. Gear for operating the Corliss type of valves for steam engines.
13800 E. S. T. Kennedy. Steam boilers.
13801 G. F. Badger and W. F. Kidder. Dredging machines.
13802 A. H. Alchin. Buffer for ships' steering gear.
13816 C. P. Jürgensen. Rotary engines.
13817 Ashcroft (W. A. Comber). Motor engines.
13820 W. Donaldson. Pumps.
13824 C. E. Hearson. Torpedoes.
13839 J. S. and J. A Morris and J. Murgatroyd. Valve.
13840 R. T. Bells. Feathering apparatus for screw propellers.
13853 W. Chadburn. Counters for indicating and registering the number of movements of parts of machines.
13858 O. Meredith. Flues and fireboxes of steam boilers.
13872 T. W. Appleyard, jun., W. K. Appleyard and C. L. Atkinson. Self-feeding stokers for boiler and ot er furnaces.
13874 E. A. Wadsworth. Obtaining motive power.
13877 G. W. Bremner. Paint suitable for ships' bottoms, &c.
13884 W. Terrell, E. Turner, and G. S. Howatson. Packing for stuffing-boxes, &c.
13903 W. Cooper and J. Holdsworth. Automatic dredger bucket.
13904 W. Cooper and J. Holdsworth. Automatic dredger bucket.
13926 C. Hill. Furnaces for steam boilers.
13932 Johnson (H. Gracpal). Furnaces or fireboxes.
13935 E. Lagosse and J. Bouché. Steam boilers.
13955 W. Hyde. Steam boilers.
13961 J. Thom. Valve gearing for steam engines.
13964 W. B. Crichton and R. O. Ritchie. Valve gear for steam engines.
13981 J. Ashworth. Utilising heat, consuming smoke and economising fuel in furnaces.
13983 J. Shaw and N. Arthur. Steam boiler and other furnaces.
13984 W. Y. Fleming and P. Ferguson. Dredgers.
13987 C. V. Boys and H. H. Cunynghame. Cleansing steam.
14022 J. F. Hailwood. Sight-feed lubricators.
14033 J. Lee. Flues of steam boilers.
14045 Lake (J. H. Blessing). Preventing incrustation in steam boilers.
14047 H. S. Marim. Machine and other guns.
14054 Newton (C. C. Worthington). Water pump and air compressor.
14059 R. M. Baily, jun. Valve gear for steam and other engines.
14062 Boult (D. A. Woodbury). Balanced slide valves.
14071 H. Schärer-Hartmann. Fire bars.
14075 H. C. Heard and A. Gardner. Packing for steam engines, &c.
14079 W. R. R. Tillion. Shaft couplings.
14080 H. F. Swan. Navigable vessels for carrying liquids, &c.
14084 C. S. Madan. Injectors for raising and forcing fluids and feeding steam boilers.
14103 W. Whyte and J. Allan. Metallic packing for pistons, &c.
14112 W. Y. Fleming and P. Ferguson. Dredging plant.
14115 G. A. Greeven. Pumps.
14122 L. Murphy. Economising oil and fuel on steamers.
14135 H. Lane and M. Delmard. Buoys, floats, &c.
14142 F. Siemens. Lining furnaces.
14155 R. Matthews. Rotary engines.
14160 R. Scott. Propelling vessels.
14161 D. A. Quiggin. Lubricators.
14180 E. J. Curtin. Furnaces and other parts of marine and other steam boilers.
14184 L. H. McMutrie. Cover for lifeboats.
14191 J. Wright. Condensing exhaust steam.

THE FASTEST WAR SHIP.—Captain F. Villamil, of the Spanish navy, who has arrived in this country, has lately concluded a contract with the firm of Messrs. J. & G. Thomson, of Clydebank, to construct a war ship, which is to have a speed of 26 miles per hour, will carry seven guns and six torpedoes, and will act as a torpedo-boat destroyer. This vessel is the first of a new type which has been suggested by Admiral Perzuela, the Spanish minister of marine; and the design of Messrs. Thomson has been selected as the best of several which have been submitted to the Spanish government.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

October 24th, 1885.

Boughton, R. J.	2C	Cardiff
Conway, H. P...	2C	London
Davies, Thos. J..	1C	Cardiff
Eckington, F. K.	1C	,,
Francis, Wm. ...	2C	,,
Fisher, Robt. W.	2C	Liverpool
Graham, T. A...	1C	London
Griffiths, Wm. ..	1C	Cardiff
Hendry, David..	1C	Dundee
Jeffries, E. B. ..	2C	Cardiff
Kendrick, John..	2C	,,
Palmgren, H. F.	2C	Hull
Preece, Thos. J.	2C	Cardiff.
Reid, James	2C	Liverpool
Sargeaunt, A. P.	2C	Cardiff
Shaw, James G.	2C	Liverpool
Tait, George....	2C	Aberdeen
Thompson, John	1C	Cardiff
Watt, Robert ..	1C	Aberdeen
West, William ..	2C	London

October 31st, 1885.

Allen, Thomas..	1C	N Shields
Baston, Wm. ..	2C	Sund'rlnd
Bell, Joseph	1C	,,
Campbell, H. ..	2C	London
Cook, H. J.	1C	Sund'rlnd
Donoghue, G. ..	1C	,,
Dower, A.	1C	Glasgow
Duncan, A.	2C	Liverpool
Ferrill, Wm.....	1C	Sund'rlnd
Graham, J. P. ..	1C	Liverpool
Hellawell, J. W.	2C	,,
Innes, John	2C	Sund'rlnd
Lees, William ..	2C	Glasgow
McColl, D. N. ..	1C	Liverpool
McDonald, J. ..	1C	N Shields
McKellar, D. ..	1C	Glasgow
Meiklejohn, J. ..	2C	,,
Miller, Donald ..	2C	,,
Moffatt, Jas.....	1C	Sund'rlnd
Munro, Alex. ..	2C	Glasgow
Palmer, David ..	1C	Sund'rlnd
Pearson, W. H..	1C	Liverpool
Pickard, L.	1C	N Shields
Potts, James ..	1C	Sund'rlnd
Radford, W. J..	1C	Liverpool
Restall, E. J. ..	2C	,,
Robertson, C.E.	E 1C	Leith
Soutan, John ..	2C	Glasgow
Stewart, Wm. ..	1C	,,
Stromberg, A. W.	2C	Sund'rlnd
Taylor, David ..	1C	Glasgow
Wallace, J. R...	2C	,,
Watt, William..	1C	Liverpool
Wright, Wm. ..	2C	N Shields

November 7th, 1885.

Ballard, Wm. H.	2C	Hull
Black, James ..	2C	Leith
Boyle, Mitchell	2C	Greenock
Boyle, Wm. R.	2C	Glasgow
Careful, T. J. ..	2C	Liverpool
Connell, Charles	1C	Greenock
Craigie, Alex. ..	1C	N Shields
Dickson, John ..	2C	Greenock
Heggie, James..	2C	,,
Holmes, Philip	2C	,,
Johnson, Leslie	1C	Liverpool
Major, James ..	1C	,,
McIver, George	2C	Leith
McKinlay, John	1C	Liverpool
Miller, Berwick	2C	Leith
Mitchell, Daniel	1C	London
Pickering, James	2C	Liverpool
Stewart, Thos...	1C	Leith
Walter, W.	1C	Liverpool
Whamond, David	1C	Leith
Wilson, Wm. ..	1C	,,

November 14th, 1885.

Anderson, Thos.	2C	Glasgow
Archbold, Chas..	2C	N Shields
Ball, A. F.	2C	London
Brown, John....	2C	Glasgow
Casebourne, C. B.	2C	W Hartpl
Collings, R. R. S.	2C	Plymouth
Evans, J. J.	1C	Cardiff
Hunter, Thomas	1C	N Shields
Kemmet, Thos. S.	2C	,,
Mabe, Edwin ..	2C	Cardiff
McRae, A......	2C	London
Norris, James ..	2C	,,
Pearce, Henry J.	2C	Greenock
Proctor, Wm E.	1C	N Shields
Robertson, Wm.	2C	Glasgow
Salisbury, C. T. J.	2C	Cardiff
Shepherd, J. G.	2C	,,
Smurthwaite, J.	2C	W Hartpl
Stobart, Wm. ..	1C	N Shields
Thomas, Cabel J.	1C	London
Walsh, Cain	1C	Cardiff
Wedlake, W. J.	2C	,,
Wood, Henry ..	2C	N Shields
Wright, Wm. H.	1C	London

THE LOAD-LINE.—At the annual meeting of the Chamber of Commerce, Mr. C. M. Norwood, M.P., speaking on the question of the load-line, said with reference to the Load-Line Committee, they had been eighteen months in arriving at their conclusions. There were several discussions on the question, and they found there was no authority which would take upon itself to fix a load-line. He suggested that the matter should be left to the owner to fix his own line, and it would then form the basis of a contract between him and the crew as to the maximum loading of his vessel. Upon his suggestion was based the load-line which was adopted in 1875, and though it suited the purpose of some people to despise that line, yet it had done good, and he was proud to hear Mr. Gray, of the Board of Trade, express the indebtedness to him for his suggestion. There was a load-line for the Indian seas for fine weather, and a load-line for the Atlantic in winter. He did not mention that to disparage the labours of the Load-line Committee, but to put before them the extreme difficulty with which the Committee had to deal.

The Marine Engineer.

LONDON, JANUARY 1, 1886.

EDITORIAL NOTES.

IT has been ascertained that the qualifications of even the best of our merchant ships, which were hired by the Government as armed cruisers and transports during the expected war with Russia, are inadequate for the purpose for which they were engaged. The truth of this is clear to those who are cognisant of the numerous and costly alterations made in the *America* and *Oregon* to render them tolerable as auxiliary cruisers. We are glad to learn, therefore, that a committee will probably be appointed to investigate and report upon the best means of utilising British Mercantile Steamers during war between this country by a formidable maritime power, and rendering such ships as efficient as possible, as aids to those of the Navy. It is to be hoped that an equitable system of subsidy will be recommended to those shipowners who may incur the great additional cost of qualifying their steamers for increasing exigencies. Several of the principal steamship companies on the Continent have been subsidised by their Governments to prevent the sale or hire of their quick liners to possible enemies, and this step alone should be a sufficient inducement for our Government to remunerate the owners of the most suitable steamers as Naval Auxiliaries, for the expense of rendering them fit for this service. It is beyond a doubt that if we were at war with a first or even second class naval power, that the whole of our swiftest liners would not suffice for the protection of our commerce alone, not to mention the other uses for which they would be required. Yet, without satisfactory means of subsidising their owners, we run the risk of having them, or some of the best of such, sold or hired to a foreign nation, which may become our most formidable enemy in maritime warfare.

THE loss of the *Indus*, off the coast of Ceylon, gives us ground for serious criticism, both on the reliability of modern steamship security, and upon the apparently imperfect knowledge with which captains are supplied for the navigation of the largest mail steamers on the most dangerous coasts. In the eastern seas, where shoal waters abound in unexpected places, and volcanic disturbances are so common, and where the constant efforts of the coral insects are ever producing new dangers to navigation, it is of the utmost importance that constant attention should be given to the discovery and mapping of any such dangers as they may arise. We might suggest that many of our present unoccupied naval squadrons or isolated cruisers might be very profitably engaged in the service of the nation, who provide their maintenance, in constant observation, and report upon such variable sources of danger to our mercantile navigation. Nor can there be any excuse for firms or companies of good standing not supplying to their captains charts, containing the very latest additions and warnings as to points of dangerous or doubtful navigation. It is exactly the overlooking of some apparently insignificant rock or shoal, which is certain to be at the bottom of some disastrous loss at sea. In the case of the *Indus* it seems that she might have escaped any serious injury from the shoal, had she not torn her bottom by coming foul of a submerged anchor, used as a point of purchase to get her off. Even then it might have been supposed that the leakage into a single compartment ought not to have been serious, provided as such vessels are with watertight compartments. It appears, however, that still her bad luck pursued her, and that the transverse bulkheads no longer proved equal to the support of the fluid pressure. How this can have happened it is difficult to surmise, unless in the designing of the bulkheads in question. The inherent weakness of a flat surface to resist pressure has been greatly overlooked. We shall take some interest, when more detailed information is to hand, in ascertaining whether such collapse of watertight compartments may be properly referred to special accident in this case, or to marks of weakness in the general design of such structures.

IN spite of the general disappointment which has been experienced by the United States Naval Department in the construction of ironclads by the well-known steamship builder, John Roach, the naval department is still pushing on its work for the construction and improvement of their ironclad navy. The chief of the United States naval bureau of "Steam Engineering" has submitted his statement of expenditure and his estimates, as well as a detailed report of the work done upon each vessel, and what he considers to be further required to place the navy in a condition of efficiency. He even recommends the building of a new boiler shop at the New York Navy yard, so that apparently the Government department is disposed rather to take the construction

into their own hands than to trust longer to private enterprise. It seems also that they have had much disappointment in a floating derrick which has been found quite defective and unsuitable for the purpose for which it was built. A new one is to be built entirely of steel, and will prove the most useful appendage to the New York Navy yard. Considerable sums during the year, amounting altogether to about £400,000, have been expended on the machinery of the double-turretted moniteurs, and of that of the new cruisers. At least eight of the old cruisers are being refitted with new boilers, and new engines and boilers are being supplied to the *Mohican.* Apparently, however, a very considerable number of present vessels are requiring new boilers and machinery, so that the department must reckon for a considerable expenditure to keep up the efficiency of the navy to a practicable point, besides heavy sums which will be required for the extension of the navy to compare with any second or third rate continental power.

THE accumulation of practical evidence from the actual observation of engineers is now so much more common than hitherto, that very valuable deductions may be frequently made from such accumulated evidence for the benefit of the profession at large. One of the least known materials at the present day is mild steel. It has fought its way into general use against a deal of early prejudice, and is now generally accepted upon a clearly definite basis of strength and dimensions, and readily passes the inspection of Lloyd's surveyors. From time to time, however, reports of the extraordinary behaviour of mild steel come to hand, showing that in many respects its behaviour is as yet a mystery to the makers and users. The most serious feature of this abnormal conduct on the part of mild steel is that which affords no evidence by any known species of test as to its fragile condition, and the breakage may therefore arise suddenly and unexpectedly, and consequently with the most disastrous results. A report of this kind that we may refer to is that afforded by Mr. Arthur J. Maginnis, M.I.N.A., with regard to the sudden and unexpected breakdown of a series of six boilers constructed of mild steel, after about two and a half years' satisfactory working. After that period, the boilers began to develop serious cracks all over their inside and external shell, some of them developing when there was no particular strain upon the boiler and with a loud report. On further examination, and the occurrence of further cracks, generally resulting it might be noticed from the test by the hammer, it was decided to take the boilers to pieces and replace them; but on attempting to do so, the whole boilers seem to have almost tumbled to pieces, cracks developing in every direction, and the parts removed coming away in fragments. Perhaps the most extraordinary feature of this case is that no testing of the material itself in small pieces afforded any indication as to the inferior quality of the material. Strips of the metal, tested both at the time when the boilers were made and after the fractures, passed the test machine triumphantly and with good credit as to strength and ductibility. The plates also worked in a satisfactory manner, welding, flanging, and bending without the least trouble. Hence, evidently such a test strip affords no indication of the condition of plate considered as a whole. Whether the plates from the first were in a condition of abnormal internal tension, rendering them liable at any time to crack under jar or strain, or whether they acquired this property after the two and a half years of use, is the mystery which at present we have no data to solve. This is a most alarming consideration for marine engineers, since now that high initial boiler pressures are used, any explosion of the boiler will probably blow the bottom of the vessel out, or so damage it that immediate foundering is almost certain to ensue. We hear now of so many vessels which disappear in mid ocean without any clue to the nature of the disaster, that one may easily be led to anticipate all sorts of mysterious accidents producing so dire a result. Perhaps the sudden failure of a mild steel boiler may be one of these hitherto unrecognised risks. It is evident, at any rate, that either with mild steel or iron boilers, now that such high initial pressures are being generally adopted, the only boiler affording reasonable safety to the structure of the vessel in case of sudden disasters, would be a multiple water tube boiler, on the principle of many so-called safety boilers now largely in use on land. It would be interesting to collect from our practical readers any accumulation of evidence as to whether any vessels, lately mysteriously foundered at sea, were fitted with modern high pressure mild steel boilers.

IT is not only to boilers and boiler plates that this mysterious action of mild steel is confined, as it has been reported from the North of England that a keel strake, after being duly bent, punched, countersunk, then annealed in the usual manner, and finally rivetted to the ship's frames, began to crack in a mysterious way after the affixing was finished, and, of course, had to be removed. After being cut out, strips were taken from the cracked plates and tested in every conceivable way

without any definite result being arrived at as to the cause of the failure, the strips showing a suitable amount of strength and ductility. It seems also that further failures, similar in kind, but much greater in extent, have since taken place—steel angle frames being included as well as steel plates. Although all this material has been duly inspected, tested, and passed at the maker's works by Lloyd's surveyors, it seems to have failed after working in an unaccountable manner. As a most forcible and experimental instance of the treacherous character of such steel, we may recount the following tests made upon a few bars selected from a quantity of angle iron delivered to a ship yard. All these bars had successfully passed Lloyd's surveyors at the maker's works. At the shipbuilders, by hammering cold for 2 or 3 ft. from the end, they were opened out and flattened down. There were no signs of giving way. They were then folded double, unfolded, flattened out, and re-folded without apparent effect. They were then left alone. Next morning the portions so tested of these angle bars were found broken in pieces, a result due apparently to the internal strain set up by the cold bend. This is an action entirely peculiar, as far as we know, to mild steel as regards shipbuilding material, no such secondary action in wrought iron having ever been experienced. It is, therefore, a very great danger to shipbuilders and shipowners unless forewarned as to this possible peculiarity of a comparatively new material. The nearest approximation of which we know with regard to this peculiar secondary action is in the case of cast-iron, in which it is well known that spontaneous fracture will occur either during working in the lathe, or afterwards when in actual employment.

It is too near guessing in the dark to attempt to form a correct opinion as to the cause of this spontaneous fracture in mild steel, but we can, at any rate, for the benefit of our readers, point out some analogies and their causes in the spontaneous fracture of cast iron, and, at the same time, may suggest such causes as may possibly have occasioned the disasters in question. It will then be for the practical users and workers in mild steel to supplement our theory by their practical tests and experience, so as to save that most useful of materials, mild steel, from any imputation of mystery or unreliability; and the sooner this is done, the better for the steel trade and shipbuilders at large. First then, as to an analogy in another metal. The spontaneous fractures of cast iron are well known to result from irregular contraction in the mould when cooling, and it is not difficult to reduce the law of such fractures to a distinct science. This science may be broadly defined to be that the exterior portion of a casting is apt to cool and set rigidly first, and that any intermediate metal, rigidly uniting the outside circumference is then strained abnormally in tension by its subsequent cooling, after the circumference has already rigidly set. This law applies to and explains spontaneous fractures in cast-iron riggers, where the fracture chiefly occurs in the arms uniting the rim as rigid diameters, and also in the case of cast-iron plates in which spontaneous fractures, developing in the centre of the plate, and seldom travelling completely outwards to the circumference, are known to develop from exposure to the weather. It is possible that all mild steel plates are liable to this development of internal abnormal tension, which may not be sufficiently great to develop immediate fracture when worked, but which will afterwards develop by exposure to alternate heat or cold, or by the jar of the rivetting hammer, or by the hammering necessary to effect the bending and working. If this is so, it will explain the fact that strips cut from such plates do not in any way indicate this peculiarity, since the moment a strip is removed from the plate, the abnormal tension is thereby relieved and the metal in itself is found to be sufficiently tenacious and ductile. Another possible cause for the development of brittleness in steel which, to a great extent, applies also to wrought iron, is the development of crystallisation by vibration or jar, and this vibration or jar may be set up in many unrecognised ways. For instance, the large amount of hammering necessary for rivetting up by the hand hammer may in itself materially affect this molecular change. The frequent vibration of the escape of steam from the safety valve is of a character possibly sufficient to develop this change. The constant vibration of the engine, working in close proximity to the boilers, may also be sufficient to effect this. A further important agent in molecular change is electricity, and at present the all-pervading nature and character of electrical currents is by no means sufficiently recognised. We note as one peculiarity in the case of the six boilers, to which we have above referred, as forming such a striking example of unaccountable failure, that they were treated from the first by the zinc method for the prevention of deposit. That is to say, zinc was constantly supplied to the interior of the boiler and renewed as fast as it dissolved and disappeared, this being a frequent and well-known method for the prevention of calcareous deposit on the heating surface. It may not, however, be generally recognised that this method simply converts the boiler into a gigantic battery, electrical action being indicated

by the gradual dissolution and disappearance of the zinc, and it is the consequent electrical current that prevents the adherence of the calcareous deposit to the heating surface. Whatever may be the effect of such continuous electrical currents upon such a susceptible and comparatively unknown material as mild steel can only be a matter for conjecture, but it may prove very serious.

THE publication in our last issue of an illustrated article upon the new marine governor, invented by Mr. Fridolf Frson. Almquist, has produced considerable commentary thereon, and, as is usual in the case of any good invention, it frequently happens that the same substantial idea occurs to, and is worked out by, more than one inventor at the same time, totally without the knowledge of the other. This seems to have been approximately the case of Mr. Almquist and Mr. C. Burnett, whose letter on the subject we print in our correspondence column, and who, as can there be seen, considers his arrangement to have advantages not possessed by that of Mr. Almquist. Their devices are quite different in construction, though with the same object in view, and, in either case, the proof of the pudding will be in the eating, and we shall be glad to hear of practical and successful application of either of these governors to actual work, which forms the only true test of their relative merit.

A TORPEDO CATCHER.

THE construction of torpedo catchers was as much a necessity in naval warfare, after the development of the torpedo system of small, quick-steaming torpedo craft, as armoured protection for battle ships became in consequence of the growth of the gun. The catchers, or police of the sea, do not differ, except in bulk and speed, from the active and dangerous little enemies which they are intended to capture or destroy, and in this respect the Admiralty would appear to have applied the old detective principle of setting a thief to catch a thief. The first of the new craft yet afloat was tried in Stokes Bay, near Portsmouth, on Friday, December 4th, with remarkable results, not only as regards speed, but also as regards manœuvring power. This latter quality of the torpedo catcher was even more noteworthy than the former, and has been secured by the application of a principle which, though successfully tried in steam pinnaces and launches and in various submarine miners built for the Royal Engineers, had not previously been adapted to first-class torpedo vessels. During the past four years we have on various occasions noticed the gradual development of the invention of Mr. John Samuel White, of East Cowes, which is now popularly known in the service as his "turn-about" system. Boats built according to this plan have their deadwood removed in order to obtain facility in turning, and are fitted with an inner and an outer rudder, simultaneously actuated, either of which would suffice to steer the vessel in the event of the other being lost or disabled. The present experimental torpedo boat was undertaken by Mr. White for the purpose of demonstrating the applicability of his invention to larger vessels, and with a view to her acceptance by the Admiralty on her fulfilling all the conditions guaranteed. She is considerably larger than any of the existing torpedo craft in Her Majesty's Navy, being 150 ft. long, 17 ft. 6 in. broad, and 9 ft. 6 in. deep. Her displacement is about 125 tons. Her lines resemble those of similar vessels now in use, but she is fitted with a turtle deck and a spur ram. Like the others she is built of thin steel, and has a conning tower amidships, from whence she will be steered in action. Messrs. G. E. Belliss, of Birmingham, the makers of all the machinery of Mr. White's boats, joined with him in the undertaking, supplying compound engines of the three-cylinder type, the high-pressure cylinder being 20 in. and the two low-pressure cylinders 24 in. in diameter, the whole being supported on light steel columns. The stroke is 18 in. Great care has been taken in the design to keep the weights as low as possible, having due regard to efficiency. There are two air pumps driven off the low-pressure cross-heads, while the feed pumps are driven direct from the crank-shaft. Steam is supplied by two locomotive boilers, with the feeds so arranged as to insure an equal supply of water to each boiler; and, as the result of the trial, the possibility of successfully employing two boilers with forced draught without difficulty, either as regards the feed or priming, was clearly demonstrated. A great feature in the design is the division of the boiler room by a longitudinal water-tight bulkhead, the connections being arranged so that either boiler can be worked independently in case of accident. The vessel is also steered by steam.

The trial, which was conducted by Mr. White and Mr. Morcom, on the part of the builder and engineers, was witnessed by Commander the Hon. F. R. Sandilands, of the Steam Reserve, Mr. T. Soper, R.N., and Mr. Smale, of the Controller's Department of the Admiralty; Chief Inspector of Machinery, Alton, and Messrs. Mayston & Gowing, of the dockyard. Admiral Herbert and a number of naval officers also watched the running from the deck of the *Camel*. The weather was somewhat boisterous, but notwithstanding the state of the sea, the vessel was remarkably steady, and also free from vibration, when going at her *maximum* speed. The total weight on board was 25 tons, 15 tons representing coal and 10 tons (furnished by iron ballast) her armament of Whiteheads and rapid-firing guns. Provision, however, has been made for carrying 35 tons of coal in the bunkers, while the space forward and aft for the accommodation of officers and crew and stores is unusually large. Six runs on the measured mile was first made for the purpose of ascertaining the speed under the special conditions of load, which resulted in the realisation of a mean speed of 20·79 knots, the mean boiler pressure being 126 lb., the revolutions 319 per minute, and the indicated horse power 1,387. The highest speed in the direction of the wind was 22·43 knots, and the following times which it took to complete the miles will show the regularity with which the speed was maintained:—With the wind, 2 min. 43 sec., 2 min. 40½ sec., and 2 min. 40½ sec. (repeated). Against the wind, 3 min. 9 sec., 3 min. 7 sec., and 3 min. 5 sec. The average I.H.P. per square foot of grate was 23, which was maintained with a mean air pressure in the stokehole of 2¼ in., which was considered a very high result. The vessel was afterwards tested in the usual manner for manœuvring power. At full speed, with the helm hard over 30 degrees, the starboard circle was completed in 1 min. 17 sec. (238 revolutions of the engines), and the port circle in 1 min. 12 sec. (270 revolutions). At half speed the starboard circle was completed in 1 min. 14 sec. (237 revolutions), and the port circle in 1 min. 15 sec. (246 revolutions). The diameter of the circles was about a length and a half of the boat, or 225 ft. The craft was finally run for three hours' continuous full-power steaming to test the endurance of the mechanism. No mishaps occurred, and the speed and revolutions were maintained throughout. The absence of vibration during the trial, as well as the very slight inclination on the helm being put hard down by the steam-steering engine, was the subject of general remark, and Mr. White and Mr. Belliss were congratulated at their joint success in the building and engining of what is regarded as the best type of torpedo catcher.

THE dockyard authorities at Sheerness have received instructions to begin the building of the *Grasshopper*—a new class of vessel described as a torpedo boat-catcher—in No. 2 dock as soon as the refit of the *Tourmaline*, composite corvette, is sufficiently advanced to admit of her being removed into the steam basin. The *Grasshopper*, which has been designed as a protection to a fleet from attack by torpedo boats, will be 200 ft. long, with a displacement of 440 tons, and will be fitted with machinery of a very powerful character, enabling her to steam at a higher rate of speed than torpedo boats. It is expected that she will be equipped with torpedoes and machine guns.

LIST OF VESSELS LAUNCHED IN 1885.

ENGLISH.

By Edward Withy & Co., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Bempton	Iron	Steam	British	1,894	800
Greystoke	,,	,,	,,	2,119	900
Emilie	,,	,,	,,	1,743	750
Beresford	Steel	,,	,,	2,158	900
Washington City ..	,,	,,	,,	2,296	1,000
Stella	,,	,,	,,	2,430	1,000

By Cochran & Co., Birkenhead.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Lighter	Iron	Tow.	British	300	—
,, ...	,,	,,	,,	,,	—
,, ...	,,	,,	,,	,,	—
,, ...	,,	,,	,,	,,	—
,, ...	,,	,,	,,	,,	—
Presid. do Ceara (Tug)	Steel	Steam	,,	30	60
Barge	,,	Tow.	,,	30	—
,, ...	,,	,,	,,	30	—
Pescador (Launch) ..	,,	Steam	Foreign	30	25
Olinda (Launch) ..	,,	,,	,,	50	100
Esperança (Trawler)..	,,	,,	,,	110	200
Fé ,, ..	,,	,,	,,	110	120
Launch	,,	,,	,,	40	50
Swiftsure (Launch) ..	Wood	,,	,,	25	30
Freetown ,, ..	,,	,,	English	25	30
Birkenhead ,, ..	Steel	,,	,,	45	60
Rosalind (Yacht) ..	,,	,,	—	75	150
Launch	Wood	,,	English	30	50
Three Barges.. ..	Iron	Tow.	,,	80	—
,, ...	,,	,,	,,	100	—
Screw Tug	Steel	Steam	,,	75	150
Waddington (Cigar b.)	,,	—	—	20	20
Screw Tug	Wood	Steam	—	15	25

By Boolds, Sharer & Co., Pallion, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Brixham	Iron	Steam	British	750	500
Norden	Steel	,,	Foreign	850	550
Eagle	,,	,,	British	130	380

By Robert Thompson & Sons, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Astoria	Iron	Sail	British	1,477	—
Waikna..	Steel	,,	,,	155	20

By Wm. Gray & Co., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Ballumbie	Iron	Sail	British	1,190	—
Limache	,,	,,	,,	824	—
Georgia	,,	Steam	,,	1,168	675
Enfield	,,	,,	,,	2,158	800
Willesden	Steel	,,	,,	2,156	800
Midnatsol	,,	Sail	Foreign	1,236	—
Latimer	Iron	,,	British	1,784	—
Suez	Steel	Steam	,,	2,165	800
Roumelia	,,	,,	,,	2,148	800
Coot	,,	,,	,,	1,942	750
Mereddio	Iron	,,	,,	1,455	540
Brentford	Steel	,,	,,	2,160	800

By Hill & Sons, Hotwells, Bristol.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Light vessel ..	Wood	—	British	—	—

By R. Craggs & Sons, Middlesbrough.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Sir Robert Peel ..	Iron	Steam	British	376	200

By John Priestman & Co., Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Walter de Lancey ..	Iron	Steam	British	845	96

By H. S. Edwards & Son, Howden-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Yard No. 19	Iron	Barge	Foreign	230	—
,, 20	,,	,,	,,	230	—
,, 21	,,	,,	,,	230	—
,, 22	,,	,,	,,	230	—
,, 23	,,	Screw	British	1,369	120
,, 24	Steel	,,	,,	1,647	140
,, 25	Iron	Barge	Foreign	175	—
,, 26	,,	,,	,,	175	—
,, 27	,,	,,	,,	230	—
,, 28	,,	,,	,,	230	—
,, 29	,,	,,	,,	230	—
,, 30	,,	,,	,,	230	—
,, 31	Steel	Screw	,,	163	40
,, 32	,,	,,	,,	1,647	140
,, 33	Iron	Barge	British	210	—

By The North of England Shipbuilding Co., Limited, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Wells City	Steel	Steam	British	1,957	1,000

By Osbourne, Graham & Co., Hylton, near Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Cambrian Chieftain ..	Iron	Sail	British	1,492	—
Dordogne	Steel	Steam	,,	891	96

And a large Iron Caisson for the River Wear Commissioners.

By Craig, Taylor & Co., Stockton-on-Tees.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
St. André	Iron	Steam	Foreign	548	300
Expedit	,,	,,	,,	552	300
Donegal	,,	,,	British	251	250

By Cottingham Brothers, Goole.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
General Stewart ..	Wood	Sail	British	89	—
Silver King	,,	,,	,,	86	—
Lord Salisbury ..	,,	,,	,,	92	—
Samuel and Ann ..	,,	,,	,,	85	—

By Pickersgill & Sons, Southwick, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Prince Edward ..	Iron	Steam	British	148	25
Chala	,,	Sail	,,	1,056	—
Chepica	,,	,,	,,	1,057	—

By Schlesinger, Davis & Co., Wallsend-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Handy, Wherry ..	Iron	Sail	British	23½	—
Salamander, Yacht ..	,,	Steam	,,	133	120

By Laird Bros., Birkenhead.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Ireland	Steel	Paddle	British	1,951	6,000
Britannia	,,	Screw	,,	1,524	1,250
Stormcock	Iron	,,	,,	372	1,500
Blackcock	,,	,,	,,	220	800

By John Blumer & Co., North Dock Shipbuilding Yard, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Primula	See	Lloyd's	Regist	er.	500

By The Blyth Shipbuilding Co., Limited, Blyth.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Edendale	Iron	Steam	British	532	80
Walter Scott	,,	,,	,,	622	90

By S. P. Austin & Son, Wear Dockyard, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Limena	Iron	Sail	British	1,084	—
Offerton	Steel	Steam	,,	744	502
Magnat	Iron	Sail	Foreign	1,010	—
Fire Queen	Steel	Steam	British	27	30

By Brundrit & Co., Runcorn.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Alert	Wood	Sail	British	156	—

By Williamson & Son, Workington.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Grassendale	Iron	Sail	British	1,860	—

By Raylton, Dixon & Co., Cleveland Dockyard, Middlesbrough.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Ching Wo	Iron	Steam	British	2,400	300
Transition	Steel	,,	,,	1,729	150
Actor	,,	,,	,,	1,649	140
Courage	Iron	,,	,,	206	50
Cabo Santa Maria ..	,,	,,	Foreign	150	25

By Campbell, Bowstead & Co., Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Melati	Iron	Sail	Foreign	1,152	—
Mootiya	Steel	Steam	,,	100	150

By Cox & Co., Falmouth.

Name of Vessel.	Built of	Class.	Owners	G.T. Regis.	H.P. I.
Empress	Iron	Steam	British	60	170
Norman	,,	,,	,,	—	95
Challenger	,,	,,	,,	76	260

By The Sulcombe Shipowning Co., Sulcombe.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Lord Devon	Wood	Sail	British	98	—

By John Knox & Co., South Hylton.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Maitland	Iron	Steam	British	160	220
Kingfisher	,,	,,	,,	160	350

By Oswald Mordaunt & Co., Southampton.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Ormerod	Iron	Steam	British	473	75
Aladdin	,,	Sail	,,	1,688	—
Scottish Glens ..	,,	,,	,,	2,114	—
Woolton	,,	,,	,,	2,152	—
Halewood	,,	,,	,,	2,152	—
Condor	,,	,,	,,	1,357	—
Bactria	,,	,,	,,	2,170	—
Fulwood	,,	,,	,,	2,170	—
Toxteth	,,	,,	,,	2,170	—
Spenser	,,	Steam	,,	2,742	300

By Thos. Royden & Sons, Queen's Pier Head, Liverpool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Britannia	Iron	Steam	British	3,129	1,400
Queen of England ..	,,	Sail	,,	2,119	—
Glenesslin	,,	,,	,,	1,821	—
Buccleuch	,,	,,	,,	2,054	—
Glenericht	,,	,,	,,	2,400	—

By W. H. Potter & Sons, Liverpool.

Name of Vessel.	Built of	Class.	Owners.	G.T. B.M.	H.P. I.
Marlborough Hill ..	Iron	Sail	British	2,578	—
Langdale	,,	,,	,,	2,150	—
Hecate..	,,	Steam	,,	1,350	—
Medusa	,,	,,	,,	1,350	—
Alarm	,,	,,	,,	250	—

By Finch & Co., Limited, Chepstow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Red Rose	Iron	Steam	British	182	90
Royal Briton	,,	,,	,,	95	95
White Rose	,,	,,	,,	120	75

By Thos. & Wm. Smith, North Shields.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Corriere-di-Roma ..	Iron	Steam	Foreign	182	277

By the Tyne Iron Shipbuilding Co., Limited, Willington Quay, Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Hispania	Steel	Steam	Foreign	1,089	140
Not Named	Iron	,,	British	1,900	200
Spring Hill	Steel	,,	,,	580	70

By the Earle's Shipbuilding and Engineering Co., Limited, Hull.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Eastwood	Iron	Steam	British	1,447	751
Eldorado	Steel	,,	,,	935	1,765
Virgo	Iron	,,	,,	135	212
Libra	,,	,,	,,	135	235
Ariel	Steel	,,	,,	2,220	1,527
Flamingo	Iron	,,	,,	255	447
Torpedo	Steel	,,	,,	418	384
Alexandra	Iron	,,	,,	66	241
Witham	,,	,,	,,	145	266
Holland	,,	,,	,,	145	266
Kesteven	,,	,,	,,	145	266
Lindsey	,,	,,	,,	145	266

By M. Pearse & Co., Stockton-on-Tees.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Akaba	Iron	Steam	British	3,921	1,800
Mount Kembla ..	Steel	,,	Colonial	716	360
Editor	,,	,,	British	1,674	560
Amana	Iron	,,	,,	3,244	1,600
Preston	,,	,,	,,	2,156	680

By Short Bros., Pallion, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Countess	Iron	Steam	British	2,197	1,080
Royal Prince	,,	,,	,,	1,852	800
J. W. Smith	,,	,,	,,	2,055	900
Tunstall	,,	,,	,,	3,255	1,500
Ocean Prince	,,	,,	,,	1,737	800

By Date & Sons, Kingsbridge.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Express	Wood	Steam	British	112	54

By Richardson, Duck & Co., Stockton-on-Tees.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Soudan	Iron	Sail	British	1,751	—
Harland	,,	,,	,,	1,742	—
Cuthona	,,	,,	,,	1,752	—
Fairholme	,,	,,	,,	1,755	—
Heliades	,,	Steam	,,	2,965	350
Indore	,,	Sail	,,	2,146	—
14 Barges	,,	—	,,	688	—

By R. & J. Evans & Co., Brunswick Dock, Liverpool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Westgate	Iron	Sail	British	1,920	—
Alliance	,,	,,	,,	993	—
Star	,,	L'tshp	,,	195	—

By James Laing, Deptford Yard, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Reg.	H.P. I.
Northern Hay ..	Iron	Sail	British	1,269	—
Octa	,,	Steam	,,	1,704	700
Miguel M. Pinillos ..	,,	,,	Foreign	3,290	1,600
Mequinez	,,	,,	British	1,214	750
Palala	,,	,,	,,	1,759	1,000
Miltiades	Steel	Sail	,,	1,440	—
N. I. S. N. Co. ..	,,	Steam	,,	940	900

By Mordey, Carney & Co., Limited, Newport, Mon.

Name of Vessel.	Built of	Class.	Owners.	G. T. Reg.	H.P. N.
Queen of the Usk ..	Iron	Steam	British	90½	60
Tantalus	Wood	Sail	,,	—	—
Flora	,,	,,	,,	—	—

By Cook, Welton & Gimmell, South Bridge, Hull.

Name of Vessel.	Built of	Class.	Owners.	G. T. Reg.	H. P. N.
Precursor	Iron	Sail	British	92	—
Bassanio	,,	,,	,,	92	—
Magneta	,,	,,	,,	88	—
Unity	,,	,,	,,	89	—
Eleanor Maria M. ..	,,	,,	,,	88	—
Good and Blanchard ..	,,	,,	,,	87	—
Plover	,,	,,	,,	89	—
Ariel	,,	,,	,,	89	—
Irrawaddy	,,	Steam	,,	130	270

By Sir W. G. Armstrong, Mitchell & Co., Limited, Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Naniwa Kan	Steel	Steam	Foreign	2,589	1,500
Tukachiho Kan ..	,,	,,	,,	2,589	1,500
Dragoman	,,	,,	British	2,815	325
Hajeen	,,	,,	,,	2,815	325
Rosalind	,,	,,	,,	71	30
Celia	,,	,,	,,	71	30
Orlando	,,	,,	,,	71	30
Panther	,,	,,	Foreign	996	700
Leopard	,,	,,	,,	996	700
No. 482	,,	,,	,,	1,233	900
Winifred	,,	,,	British	20	10

By Miller, Tupp & Rouse, Hammersmith.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Albatross	Wood	Steam	British	20	30
Mosquito	,,	,,	,,	5	15
Laurel	,,	,,	,,	2	4
Mahseer	,,	,,	,,	8	10
Johnny	,,	,,	Foreign	11	22
Hyacinth	,,	,,	,,	3	6
Goshawk	Steel	,,	British	5	15
Elfin	Wood	,,	,,	3	6
Colibre	,,	,,	Foreign	2	3
Squid	,,	Sail	British	2	—

By C. S. Swan & Hunter, Wallsend-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Denbyshire	Iron	Steam	British	2,538	1,430
Burrumbeet	Steel	,,	Colonial	2,420	1,550
Corangamite	,,	,,	,,	2,420	1,550
Eveline	,,	,,	British	1,351	800
Newcastle	,,	,,	,,	1,380	800
Cabo Trafalgar ..	Iron	,,	Foreign	1,542	900
Oliva	Steel	,,	,,	1,150	850

By Rennoldson & Sons, South Shields.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Spencer Walpole ..	Iron	Steam	British	154	325
General Gordon ..	Wood	,,	,,	97	200
Flying Fox	Iron	,,	,,	174	400
Australia	Wood	,,	,,	92	210
Gleaner	Wood	,,	,,	87	210
Flying Fish	Iron	,,	,,	175	400

By Yarrow & Co., Blackwall.

Name of Vessel.	Built of	Class.	Owners.	Dimensions.
Barge ..	Steel	—	Foreign	76ft. by 15ft. by 4ft. 9in.
Launch ..	,,	Steam	,,	72 ft. by 10 ft. 6 in.
2 Launches..	,,	,,	,,	53 ft. by 10 ft.
Launch ..	Teak	,,	,,	28 ft. by 6 ft.
Ditto ..	Steel	,,	,,	65 ft. by 12 ft. 6 in.
Paddle-wheel Steamer ..	,,	,,	,,	45 ft. by 8 ft.
2 Stern-wheel Steamers..	,,	,,	British	138 ft. by 23 ft.
3 Ditto ..	,,	,,	,,	98 ft. by 18 ft.
3 Ditto ..	,,	,,	,,	98 ft. by 18 ft.
Launch ..	,,	,,	Foreign	46 ft. by 7 ft.
Stern-wheel Steamer ..	,,	,,	,,	55 ft. 6 in. by 9 ft. 6 in.
Tug-boat ..	,,	,,	,,	40 ft. by 10 ft.
Torpedo Boat	,,	,,	,,	117ft. 8in. by 12ft. 6in.
Launch ..	,,	,,	,,	85 ft. by 14 ft.
Ditto ..	,,	,,	,,	40 ft. by 6 ft.
Electric Torpedo ..	,,	,,	British	35 ft. by 3 ft. by 3 ft.
2 Torpedo Bts	,,	,,	Foreign	135 ft. by 13 ft. 9 in.
2 Ditto ..	,,	,,	British	110 ft. by 12 ft. 6 in.

By John Readhead & Co., West Docks, South Shields.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Woodcock	Iron	Steam	British	330	926
Carlton	,,	,,	,,	2,011	835
Treneglos	,,	,,	,,	1,642	766
Trevean	,,	,,	,,	1,649	766
Isle of Georgia ..	,,	,,	,,	1,352	668
Grao	,,	,,	Foreign	1,466	950
Carl Rahtkens ..	,,	,,	British	1,730	731
Richard Kelsall ..	,,	,,	,,	1,729	633
William Jolliffe ..	,,	,,	,,	332	970

By Messrs. Samuda Bros., Poplar.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Aquidaban	Steel	Steam	Foreign	2,711	4,500
10 Barges	,,	Sail	British	120	—
12 ,, ...	,,	,,	,,	372	—
4 ,, ...	,,	,,	,,	100	—
Dredger	,,	—	Foreign	45	—
Pontoons	,,	—	,,	7	—

By Leslie, Andrew & Co., Hebburn-on-Tyne (now R. & W. Hawthorn, Leslie & Co.).

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Ovingham	Iron	Steam	British	1,950	200
Garrick	,,	,,	,,	2,527	300
Palameo	,,	,,	,,	2,376	400
Prometheus	,,	,,	,,	2,376	400
Port Victor	Steel	,,	,,	2,793	400
Dryden	Iron	,,	,,	2,812	300

By William Dobson & Co., Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Ouse Hopper No. 1 ..	Iron & Steel	Steam	British	488	75
,, ,, No. 2 ..	,,	,,	,,	487	75

By Palmer's Shipbuilding & Iron Company, Limited.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Iron Steamer ..	Iron	Steam	British	1,447	750
Mount Olivet ..	,,	,,	,,	2,510	1,200
Surprise	Steel	,,	,,	980	3,200
Alacrity	,,	,,	,,	980	3,200
Four Winds ..	Iron	Sail	,,	1,857	—
Dovenby Hall ..	,,	,,	,,	3,068	—
Knight of St. John	Steel	Steam	,,	3,457	2,200
Knight Errant ..	,,	,,	,,	3,452	2,200
Buffalo	,,	,,	,,	4,427	3,800
Cabo Finisterre ..	Iron	,,	Foreign	1,602	900
Flambro	Steel	,,	British	1,975	1,150
6 Barges	—	—	,,	300	—

By Wigham, Richardson & Co., Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Sitina..	Iron	Steam	Foreign	1,001	800
Shannon	,,	,,	British	139	—
Buccaneer	Steel	,,	,,	785	1,100
Foxhall	,,	,,	,,	843	1,100
Haiphing	Iron	,,	,,	1,743	1,200
Bayhadi	,,	,,	,,	1,704	1,200
Restitution	Steel	,,	,,	3,363	1,700
Formosa	Iron	,,	,,	1,098	1,000
Flora	,,	,,	Foreign	712	600

By W. Allsup & Sons, Preston.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
Warrior	Iron	Steam	British	51	120
Dikili	,,	,,	Foreign	160	330

By Edwards & Symes, Cubitt Town, E.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Victory	Steel	Steam	British	40	60
	Iron	Pont.	Foreign	20	—
	,,	,,	British	100	—
Clotho..	,,	Steam	,,	30	70
Steam Launch ..	Wood	,,	,,	20	40
,, ...	,,	,,	,,	20	40
,, ...	,,	,,	,,	20	40
San Jo-é	,,	,,	,,	15	20
Steam Launch ..	Composite	,,	Foreign	20	—
Progreso	Steel	,,	,,	150	350
Steam Launch ..	Wood	,,	,,	10	10

By Waite & Son, West Cowes, Isle of Wight.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Thrasher	Steel	Steam	British	26	11
Opal	,,	,,	,,	44	12
Hornet	Wood	,,	,,	9	7½
No. 86 (Name not known)	Steel	,,	,,	11	7½

By Hepple & Co., North Shields.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Leonard Brown ..	Iron	Paddle	British	87	32
Blucher	,,	,,	,,	105	40
Victor Hugo	,,	Screw	,,	28	30
Condor	,,	,,	,,	28	30
Andrew Bain.. ..	,,	Paddle	,,	111	40

By The Sunderland Shipbuilding Co., Limited, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Reg.	H. P. N.
Heathpool	Iron	Steam	British	974	110
Gian Paolo	,,	,,	Foreign	461	70
Semiramis	,,	,,	British	432	70

By W. Doxford & Sons, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
Richard Hayward ..	Iron	Sail	Foreign	1,687	—
Kate Thomas ..	,,	,,	British	1,748	—
Cadwgan	Steel	,,	,,	1,303	—
Principality	Iron	,,	,,	1,758	—

SCOTCH.

By Napier, Shanks & Bell, Yoker, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Hercules	Iron	Steam	British	197	540
*Cargo Flat	Steel	Sail	Indian	720	—
*Cargo Flat	,,	,,	,,	720	—

* These were sent abroad in pieces.

By Murdock & Murray, Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Trojan..	Steel	Steam	British	240	380
Scythian	,,	,,	,,	240	380
Dot	Iron	,,	Foreign	22	60
*No. 93 S. S. ..	,,	,,	British	379	—
Captain M'Clure ..	,,	,,	,,	503	450

* Taken to pieces for shipment.

By Barclay, Curle & Co., Limited, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N. & I.
Loch Broom	Iron	Sail	British	2,128	—
Loch Carron	,,	,,	,,	2,128	—
Her Majesty	,,	Steam	,,	235	140
Diana Vernon ..	,,	,,	,,	193	103
County of Edinburgh	,,	Sail	,,	2,160	—
Armida	Steel	,,	,,	1,710	—

12 Torpedo Steam Cutters for the Admiralty, about 5 tons each, and 18 I.H.P.

By Simmons & Co., Renfrew.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
No. 4 Dredger ..	—	—	British	350	370
Surprise, Hopper D'ger.	—	—	Foreign	482	350
Ville d'Eu, ,, ,,	—	—	,,	482	350
Melbourne, Dredger..	—	—	Colonial	706	800
Leven, Hopper Dredger	—	—	British	856	900
No. 3 ,, ,,	—	—	,,	866	900
No. 4 ,, ,,	—	—	,,	866	900
Steam Launch ..	—	—	,,	15	40
Gefion, Hopper Dredger	—	—	—	460	350

By T. B. Seath & Co., Rutherglen, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
Ossian..	Iron	Steam	British	97	130
Sunbeam	,,	,,	,,	75	180

By Birrell, Stenhouse & Co., Dumbarton.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Benavon	Steel	Sail	British	1,470	—
Forfarshire	Iron	,,	,,	1,354	—

By Archibald Macmillan & Son, Dockyard, Dumbarton.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Marion Crosbie ..	Steel	Sail	British	1,054	—
Gartmore	,,	,,	,,	1,080	—
Aberfoyle	,,	,,	,,	1,661	—
Frances Fisher ..	,,	,,	,,	1,478	—
Ventura	,,	,,	,,	1,710	—
Ariadne	Iron	,,	,,	1,214	—
Bowman B. Law ..	,,	,,	,,	1,391	—
Celtic Chief	,,	,,	,,	1,787	—
Balmoral Castle ..	,,	Steam	,,	* 1,853	—

* Tonnage rebuilt and added.

By Caird & Co., Greenock.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Guahy	Steel	Steam	Foreign	336	600
Coromandel	,,	,,	British	4,496	4,500
Bengal	,,	,,	,,	4,497	4,500

By Pearce Bros., Dundee.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Tay	Steel	Steam	British	147	180
Eagle	,,	,,	Foreign	207	570
Lilian	,,	,,	,,	338	330

By Robert Duncan & Co., Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Atalanta	Iron	Sail	British	1,752	—
Minnyhive	,,	,,	,,	1,348	—
Ruthwell	,,	,,	,,	1,348	—
Ochtertyre	,,	,,	,,	1,354	—
Corryvrechan ..	Steel	,,	,,	1,356	—
Timandra	Iron	,,	,,	1,561	—
Euphrosyne	Steel	,,	,,	1,905	—

By W. B. Thompson, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Firth of Stronsa	Iron	Sail	British	1,319	—
Chili	,,	,,	Foreign	1,308	—
Firth of Solway	,,	,,	British	1,313	—
King Malcolm	,,	,,	,,	1,327	—

By John Fullerton & Co., Paisley.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Salem	Steel	St. Yt.	British	82·13	150
Fuebracho	,,	Steam	Foreign	129·25	400
Quinta Hermosa	Iron	,,	,,	127·40	180
Alert	,,	,,	British	122·04	360
Pearl	,,	,,	,,	473·78	400

By Ramage & Ferguson, Leith.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Mascotte	Steel	Steam	Foreign	1,060	1,300
Malacca	Iron	,,	British	653	740
Katrena	,,	,,	,,	400	508
El Callao	,,	,,	,,	1,019	680
Henry Venn	Steel	,,	,,	96	150
El Altrivado	Iron	,,	,,	20	70
Lady Beatrice	,,	,,	,,	339	337
Crown of India	,,	Sail	,,	2,055	—
Crown of Italy	,,	,,	,,	1,617	—

By Abercorn Shipbuilding Co., Paisley.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Hersilia	Iron	Sail	Foreign	250	—
Electric	Steel	Steam	British	13	5
Atlantic	Iron	,,	Foreign	75	45

By David & Wm. Henderson & Co., Meadowside Works, Partick, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Amy	Steel	Steam	British	657	—
Mohican	,,	,,	,,	537	—
Gardenia	,,	,,	,,	461	—
Inishtrahull	,,	,,	,,	945	—
Saltees	,,	,,	,,	577	—

By Hull Russel & Co., Aberdeen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
St. Clement	Iron	Screw	British	180	380
Seagull	Steel	Paddle	Calcutta	1,010	1,460
Matabele	Iron	Screw	British	1,570	840

By Scott & Co., Bowling, near Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Kenilworth	Iron	Steam	British	274	520
*Steel Paddle	—	,,	Foreign	200	—
Tartar	Iron	,,	British	169	445
Polar Light	,,	,,	,,	60	85
Acolite	,,	,,	,,	60	85
Dunrobin	,,	,,	,,	340	462
Battle Isle	,,	,,	,,	187	477

* Shipped in pieces.

By Aitken & Mansel, Whiteinch, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Laura	Steel	Steam	British	616	1,200
Moravia	,,	,,	,,	1,387	800

By R. Napier & Sons, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Electra	Steel	Steam	British	1,219	1,296
Manavi	,,	,,	,,	1,041	824
Recorder	,,	,,	,,	1,201	1,400
Mirror	,,	,,	,,	1,600	1,600

By W. S. Cumming, Blackhill Dock, Monkland Canal, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Yacht	Composite	Steam	Foreign	63	65
Lighter, No. 19	Iron	—	British	27	—
,, No. 20	,,	—	,,	27	—
,, No. 21	,,	—	,,	27	—
Sprite	Steel	Steam	,,	15	55
Elf	,,	,,	,,	15	55
Lily	,,	,,	,,	12	60
Launch	Composite	,,	Foreign	8	12

By Ross & Duncan, Whitfield Works, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Launch	Wood	Steam	Foreign	6	25
,,	,,	,,	British	6	25
,,	,,	,,	,,	6	25
,,	,,	,,	Foreign	6	25
Valletta	,,	,,	British	5	10
Lily	Steel	,,	Foreign	15	65
Launch	Composite	,,	,,	6	25
Yacht	,,	,,	,,	60	80

By W. Swain & Co., Kelvin Dock, Maryhill.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
John Strachan	Iron	Steam	British	120	22½

By M'Knight & Co., Ayr.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Kyle	Iron & Steel	Steam	British	600	101
Linda Park	,,	Sail	,,	357	—

By D. Allan & Co., Grantown.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Secunda	Wood	Steam	Foreign	118	250
Degrave	,,	,,	,,	118	250
Tertia	,,	,,	,,	118	250
Le Glorieux	,,	,,	,,	118	250
Gran-canto	,,	,,	,,	70	250

By The Campbeltown Shipbuilding Co., Campbeltown.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Curlew	Iron	Steam	British	306	400

By Alex. Stephen & Sons, Linthouse, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Ardencaple	Steel	Sail	British	1,783	—
Damara	Iron	Steam	,,	1,779	200
Abercorn	,,	Sail	,,	1,341	—
Ulunda	,,	Steam	,,	1,789	200
Brynhilda	,,	Sail	,,	1,503	—
Nerissa	Steel	Steam	,,	344	120
General Gordon ..	,,	,,	,,	1,359	140
Circé	Iron	Sail	Foreign	1,651	—

By S. & H. Morton & Co., Leith.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Britannia	Steel	Steam	British	624	120

By Hawthorns & Co., Leith.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Lizzie	Wood	Steam	British	35	50
Tantallon	,,	,,	,,	35	50
Alexandra	Iron	,,	,,	28	140
Dart	,,	,,	,,	28	140
Quarta	,,	,,	Foreign	92	190
Le Lillois	,,	,,	,,	92	190

By John Reid & Co., Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
John O'Gaunt ..	Steel	Sail	British	1,200	—
Galatea	,,	,,	,,	90	—
Floating Feather ..	Wood	,,	,,	5	—
Orellana	Steel	,,	,,	900	—
Maule	Iron	Steam	Foreign	325	—

By Gourlay Brothers & Co., Dundee.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Richmond	Steel	Steam	British	628	600
Dundee	,,	,,	,,	1,305	2,000

By Alex. Stephen & Sons, Dundee.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Thetis	Steel	Sail	British	1,374	—

By The London & Glasgow Co., Limited, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Rosshead	Iron	Sail	British	1,105	—
Girvan	Steel	,,	,,	1,337	—
Pass of Leny.. ..	Iron	,,	,,	1,316	—
Savaar..	Steel	Steam	,,	543	155
Lee Sang	,,	,,	,,	1,698	300

By A. & J. Ingles, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
General Gordon ..	Steel	Steam	British	816	1,800
—— ..	,,	,,	—	2,997	2,500

By Blackwood & Gordon, Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Ban Whatt Hin ..	Iron	Steam	British	361	500
Isla	,,	,,	,,	109	88
Tamar..	,,	,,	,,	65	88
Griffin..	,,	,,	,,	65	88
Dolphin	Steel	,,	,,	85	240
Hö Kwéi	,,	,,	,,	375	500

By Marr Brothers, Leith.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Alice	Wood	Steam	British	46	14
Pioneer	,,	,,	,,	46	14
British Prince ..	,,	,,	,,	46	20
Elfin	,,	,,	,,	10	6

By W. Denny Bros., Dumbarton.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Lalpoora	Steel	Steam	British	3,269	2,500
Laivada	,,	,,	,,	3,269	2,500
Amherst	,,	,,	,,	237	400
Mindoon	,,	,,	,,	897	1,200
Tomah..	,,	,,	,,	897	1,200
Mararia	,,	,,	,,	2,466	3,500
Barcoo..	,,	,,	,,	1,505	2,600
Lohara	,,	,,	,,	3,270	2,000
Aphynik	,,	,,	,,	65	160
Nyoung-don	,,	,,	,,	65	160
Momcin	,,	,,	,,	483	800

By The Fairfield Shipbuilding & Engineering Co., Limited.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Bangkok	Steel	Steam	British	307	537
Stern Wheeler (Ibi)	,,	,,	,,	300	300
Stern Wheeler ..	,,	,,	,,	150	200
,, ...	,,	,,	,,	150	200
,, ...	,,	,,	,,	150	200
,, ...	,,	,,	,,	150	200
,, ...	,,	,,	,,	150	200
,, ...	,,	,,	,,	150	200
,, ...	,,	,,	,,	150	200
,, ...	,,	,,	,,	150	200
,, ...	,,	,,	,,	150	200
,, ...	,,	,,	,,	150	200
Red Cross	,,	,,	,,	145	200
Gun Boat	,,	,,	,,	150	200
,, ...	,,	,,	,,	150	200
,, ...	,,	Screw	Foreign	5,500	7,000
Lyons	,,	Steam	British	487	1,600
Italy	,,	,,	,,	487	1,600

By Messrs. Fleming & Ferguson, Paisley.

Name of Vessel	Built of	Class.	Owners.	G.T. Regis.	H.P.
Phœnix	—	Steam	British	30	100
Gladstone	—	,,	,,	300	300
India	—	,,	,,	100	80
Hopper Dredger ..	—	,,	,,	600	600

By Wm. Hamilton & Co., Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Glenlora	Steel	Sail	British	1,280	—

By McArthur & Co., Abbotswich, Paisley.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
No. 33..	Steel	Steam	Foreign	17	30
No. 34..	"	"	"	62	75
No. 35..	"	"	"	62	75
Douglas	"	"	British	55	50
No. 38..	"	"	Foreign	11	40

By J. M'Kenzie & Co., Leith.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Osprey	Wood	Steam	British	47	50
Petrel	"	"	"	47	50
Merlin..	"	"	"	47	50
Fulmar	"	"	"	47	50
Evelyn	"	"	"	47	60
Perseverance	"	"	"	47	50

By Charles Connell & Co., Whiteinch.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Charles Connell ..	Iron	Sail	British	1,724	—
Edinburgh	"	"	"	1,472	—
Lismore	"	"	"	1,675	—
Sirenia	Steel	"	"	1,669	—

By Russell & Co., Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T.	H.P. I.
Kohilla	Iron	Sail	British	1,662	—
Earl Rosebery ..	"	"	"	1,173	—
Earl Dunraven ..	"	"	"	1,347	—
Moy	"	"	"	1,697	—
Avoca	"	"	"	1,703	—
Hilston	"	"	"	2,085	—
Lucipara	"	"	"	1,943	—
Bandanena	"	"	"	1,944	—
Anamba	"	"	"	1,141	—
Natuna	"	"	"	1,137	—
Fifeshire	"	"	"	1,357	—
Victoria Bay	"	"	"	1,172	—
Dundale	"	"	"	1,169	—
Arctic Stream ..	"	"	"	1,584	—
Clan Macpherson ..	"	"	"	1,680	—
Isabel Brown.. ..	"	"	"	1,325	—
Kilmory	"	"	"	1,630	—
Waverley	"	"	"	1,166	—
Port Sonachan ..	"	"	"	1,166	—
Tay	"	"	"	1,664	—
Dee	"	"	"	1,168	—
Don	"	"	"	1,168	—
Sardhana	"	"	"	1,145	—
Hyderabad	"	"	"	1,147	—
Emasiel	"	"	"	1,873	—
Malaysia	"	"	"	1,876	—
Earscourt	"	"	"	1,166	—
Soudan	"	"	"	1,567	—

By The Grangemouth Dockyard Company, Grangemouth.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Margaret Murray ..	Steel	Sail	British	185	—
Vaitarna	"	Steam	Foreign	292	610
Clytie	"	Sail	British	334	—
Knight of St. Patrick	"	Steam	"	275	900
Karli	"	"	Foreign	64	200
Florance	Wood	Sail	"	15	—
Ilma	Steel	"	"	335	—

By David J. Dunlop & Co., Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H. P. I.
Princess Maud ..	Iron	Steam	British	750	850

By James & George Thomson, Clydebank.

Name of Vessel.	Built of	Class.	Owners.	Tons.	H. P. I.
Grenadier	Steel	Steam	British	372	1,000
Alluera	"	Sail	"	1,554	—
Scout	"	Steam	"	1,460	3,350
Ilamaraty	"	"	Foreign	401	1,250
Archer..	"	"	British	1,630	4,000

IRISH.

By McIlwaine Lewis & Co., Limited, Belfast.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Lady Arthur Hill ..	Iron	Steam	British	271	346

By Harland & Wolff, Belfast.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Callao	Steel	Sail	British	1,017	—
Belgic	"	Steam	"	4,212	2,700
Santiago	"	Sail	"	1,017	—
Teneriffe	"	Steam	"	1,800	1,000
Gaelic	"	"	"	4,206	2,700
Elmina	"	"	"	1,764	1,000
Costa Rican	"	"	"	3,251	1,900
Zemindar	"	Sail	"	2,120	—
Irene	"	Steam	"	897	1,700
Talookdar	"	Sail	"	2,120	—
Queen's Island ..	"	"	"	2,093	—
Caloric	"	Steam	"	880	1,500
Optic	"	"	"	880	1,500

LAUNCH OF THE TWIN SCREW TORPEDO STEAMER "ARCHER."

On December 23rd Messrs. J. and G. Thomson launched from their shipbuilding yard, Clydebank, Glasgow, a twin screw torpedo steamer for the British Government. The ceremony tock place in the presence of a large and distinguished company. Lady Campbell, of Blythswood, christened the vessel by the name of *Archer*.

The vessel is the first of the six vessels of the *Scout* class which were contracted for in May of last year to be built for the Admiralty. These vessels were given to the Messrs. Thomson as the result of a competition into which 38 firms were invited to engage. The Archer is 225 ft. long between her perpendiculars, or about 240 ft. over all. Her beam is 36 ft. and her depth 19 ft. Her displacement tonnage is 1,630 in what is called her normal seagoing condition, or 1,810 tons when fully equipped with all the coals and stores she can carry. The speed of the vessel is expected by the Admiralty to be more than 16½ knots; her builders, judging by the exceedingly successful results of the speed trials of the *Scout*, are looking forward to nearly 18 knots in this vessel. She is propelled by twin screws, and has engines of 4,000 I.H.P The boilers are four in number, and of the Navy type, having tubes in the ends of the furnaces; the total weight of the machinery 350 tons, a weight which in an ordinary merchant steamer's machinery would only be capable of being accompanied by about 2,200 I.H P. The gun armament of the *Archer* consists of six 6-inch breech-loading rifled guns mounted on central pivoted carriages and eight machine or rapid-firing guns. The torpedo armament consists of ten tubes, one forward

and one aft, each firing in a fore and aft direction above the water, two on each broadside under cover of the poop or forecastle, and one on each broadside in the open part of the middle of the ship. There are also two under-water tubes, one on each side. The protection afforded to the guns and torpedo tubes is partly by means of a shield over the rear of the guns or torpedo tubes to protect the men firing, and partly by means of plating one inch thick on the ship's side. The ship herself relies upon her very extensive system of subdivision for her protection, the part near the water-line in particular being minutely divided. The coal bunkers are also arranged to give protection to the boilers, engines, and magazines, and the whole of the vital parts are covered by a water-tight deck a little below the water-line. The vessel has very strong steam steering gear placed under water, and acting on a rudder of nearly 100 square feet of area. It is expected that the time to turn a complete circle with both screws going ahead will be as little as four minutes, and that the diameter of the circle will not exceed 300 yards. With one screw going ahead and the other astern the time will be about the same, but the circle will naturally be much less. The amount of coal which the *Archer* can carry is sufficient to drive her at 10-knot speed for 7,000 knots, or for about 2,500 knots at full speed. The vessel has two complete decks, the upper and the lower. She also has a poop and forecastle deck, each about 50ft. long, between which is a high bulwark forming a hammock netting, and giving the vessel an unbroken sheer line from stem to stern. The bow is formed with a clipper-shaped stem above the water, and a projecting ram below the water. The stern is formed like an ordinary merchant ship's, and the appearance of the vessel is very yacht-like, which is somewhat unusual in war-ships. Her rig is to be of the three-masted schooner type, with a crow's nest or military top on the foremast for working a machine gun. The vessel is built of steel throughout, and every precaution has been taken to ensure the proper strength with the greatest lightness. The parts of the hull most subject to corrosion have been galvanised, and the inside of the outer bottom has been coated with Day's protective cement. The construction of the vessel and her machinery has been superintended on behalf of the Admiralty by Mr. Darley, one of the Admiralty constructors, and by Mr. Maudling, engineer, R.N.

After the launch the company had luncheon in the model room of Messrs. Thomson's establishment. Sir Archibald Campbell, M.P., presided. Mr. W. H. White, Director of Naval Construction at the Admiralty, in acknowledging the toast of success to the *Archer*, said that, as he was out of the public service at the time the design was selected, he could speak of it with the greatest impartiality. In his opinion there could be no doubt that in the *Scout*, *Archer*, and other vessels in process of construction, the Navy would receive the addition of a class of ships that could not fail to be of extreme use in circumstances of peace or war. They represented in their design some of the latest improvements in ship construction and marine engineering, and the design had received an execution and a practical development at the hands of the builders for which they were extremely grateful. He had been present the previous day at the launch of a German steamer of immense proportions, and on that occasion Mr. Pearce, M.P., the builder of the vessel, stated that she would cross the Atlantic at a speed of 18 knots, or 1½ knots faster than the fastest cruiser building for the English Navy. It was a dangerous thing to prophecy before one knew, but he regarded this statement as an undue depreciation of the ships of war. Of course a ship designed for passenger accommodation, to cross the ocean and make regular passages at top speed, was a different vessel from one which existed primarily to fight, and in which every quality of the design had to be subordinated to fighting efficiency. If he were left free to build a ship to steam 18 knots an hour, he would not limit her length to 300 ft., but when a vessel had to be fitted with torpedoes, and had to charge down an enemy and ram her, when she had to fight her guns to the best advantage and to be built at a certain cost, then the luxury of length with which they were acquainted in merchant ships could not be indulged in. He wished further to say that there were ships and ships. No one type of ship comprised in the Navy could do all the work of the fleet; no one type of ship could do the work of peace and of fighting. No one admired more than he did the merchant vessels, which were the product of the private skill and enterprise of the country; but a war ship differed so widely from these vessels that they were not to be compared. He was glad to say that in England we had in the merchant fleet a great source of strength whenever the time of trial came. This fact was fully realised under recent conditions, but they must go on building ships for war as well as for peace service.

THE PETERHEAD HARBOUR OF REFUGE.

THE plans of the works to be executed in constructing the Harbour of Refuge at Peterhead have now been lodged with the Sheriff Clerks at Aberdeen and Peterhead, as well as with the session-clerk of the parish, and are open for public inspection, and from them an accurate idea may now be gained by the public of the operations which the Government propose to carry out. The main design of the structure differs materially from that of Mr. Stevenson which the Harbour Trustees laid before the Sub-Committee who visited Peterhead in the course of their investigations into the question of the best site. Mr. Stevenson, in his last plan, showed a pier of 550 ft. long on the north side, a forked pier 250 ft. long on the south side, and a large detached breakwater in the middle, extending across the bay, and leaving entrances at either end. The Commissioners, however, considered it doubtful whether there should be any opening on the south side, and the official plans show that this feature of Mr. Stevenson's scheme has not been adopted. Nor does the breakwater contemplated by the Government assume the slightly convex form shown in the plan which Mr. Stevenson designed for the Harbour Trustees; both piers, as delineated on the plans now lodged, extending in a straight line directly across the bay. The pier on the north side will start from the south-east corner of the reclaimed land at Keith Inch and will be 1,000 ft. in length, while the main break-water, starting from Salthousehead, close to St. Catherine's Cottage, will be 3,200 ft. long, leaving an entrance 600 ft. wide between the two piers. The piers will have a uniform height of about 24 ft. 6 in. above low water of spring tides, or about 12 ft. above high water, and will rest on a wide rubble foundation coming up to about 23 ft. below low water. At the entrance and for the greater part of the length of the main pier, the height of the structure from the parapet to the bed of the sea, is from 82 to 85 ft. The south breakwater reaches deep water about 1,000 ft. from its shore end, and there the height of the structure above the bed of the sea is 77 ft.; thence to the entrance it varies, according to the inequalities of the bottom, from 77 to 82 ft. The north pier gets clear of the rocks 300 ft. from its shore end, and for the remaining 700 ft. it varies in height from 77 to 85 ft., the latter being the height at the entrance, where 60 ft. of the structure, therefore, is below the low water mark. The water area in the harbour will be about 400 acres; about 200 acres being within the four-fathom line. Besides these main piers, the scheme includes a retaining wall of 117 ft. in length running along the face of the reclaimed ground at Keith Inch.

The quarry from which the materials are to be taken is on the western slope of Stirlinghill, upon the estate of Stirlingbrae, belonging to the trustees of the late Mr. Lendrum. The ground to be acquired consists of some twenty-six acres, upon which some houses at present stand. No portion of the slope has been previously worked as a regular quarry, but the substratum is believed to be a very fine quality of granite in massive blocks, peculiarly suitable for the construction of such a work. From the quarry to Salthousehead a railway will be run for the conveyance of the material, the length of the line being 2 miles, 3 furlongs, and 9 chains. It starts from a field at present in the occupation of Mr. George Milne, and situated on the opposite side of the burn from the farm of Whinbush, this point being some 167 ft. of an altitude above the level of the terminus at Salthousehead; but the line is pretty level till after crossing the turnpike road, from which to the end the gradient is about 1 in 40. The railway crosses the public road from the Den of Boddam to Stirling Village, for which purpose the roadway will be raised 13½ ft., and a bridge erected. Thereafter the line passes through the estate of Sandford, crossing the road leading to Newton; it crosses the turnpike road by an overhead bridge about a mile from the terminus, and a little further on, near Glenugie distillery, it crosses a deep gully by a viaduct 74 yards long, with a height of 42 ft. above the bed of the stream at the deepest part. The road leading from Upperton to the turnpike is to be diverted, in order to facilitate the railway works, and will run parallel to the line, joining the turnpike near the proposed bridge. A new road is also to be made at the quarries.

The book of reference, showing the lands, &c., to be acquired for the purpose of the works—a large volume of many pages—is also lodged for inspection along with the plans.—*Peterhead Sentinel.*

THE *Times* states that there is reason to believe that Professor Elgar has accepted the appointment of Director of Dockyards.

R. KENT JONES' PATENT CONTINUOUS MOTION RATCHET BRACE AND OTHER TOOLS.

We have selected from a number of tools manufactured by Mr. R. Kent Jones, of the Eureka Works, Birkenhead, the three which we now have pleasure in illustrating and describing as being the most likely to prove of interest to our readers, and we are confident that it will need but a cursory view to convince those interested that these tools possess in no small degree the qualifications of simplicity, ingeniousness, and wide range of applicability.

Fig. 1.

The tool which we purpose describing at greatest length is the inventor's patent duplex continuous motion ratchet brace, shown at Fig. 1, and we so describe it for the reason that the broad principles of it form the means of applying the motive power to the patent portable boring tool illustrated by Fig. 2.

Referring to Fig. 1 it will be seen that the drill stock is provided with two toothed wheels. One of these keyed to the stock is an annular wheel, having ratchet teeth on its exterior periphery, and cogged teeth on its interior periphery; the other, mounted loosely on the stock, has its ratchet teeth cut in the opposite direction to those on the annular wheel and is provided with a boss having cogged teeth which project into the hollow of the annular wheel. The internal cog-teeth are geared together by small pinions, arranged in the annular space between the teeth and mounted on the lever arm shown as secured to the standard of the brace. The operating lever, moving loosely on the drill stock, is provided with two pawls, working in opposite directions and gearing respectively with the two ratchet wheels.

After the above brief description it will readily be seen that, if the lever arm be operated in the ordinary manner, during one motion the drill will be driven direct by means of the pawl gearing with the ratchet wheel fixed on the drill stock, the other pawl passing over the teeth of the second wheel. During the back stroke of the lever the drill is still driven in the same direction through the pawl gearing with the second ratchet, the cog teeth on its boss, the pinions on the secured lever arm, and the internal teeth on the annular wheel, the first pawl now sliding freely over the ratchet teeth of the annular wheel into position for the next stroke. When the arm secured to the standard is released and operated together with the lever by the two hands so that they alternately approach to and recede from one another, the speed of the drill is increased, while by operating the two arms so that they move in the same direction as one lever, greater power is obtained. The tool is made with either hand or automatic feed, the latter being obtained by means of an adjustible strap acting on the feed nut.

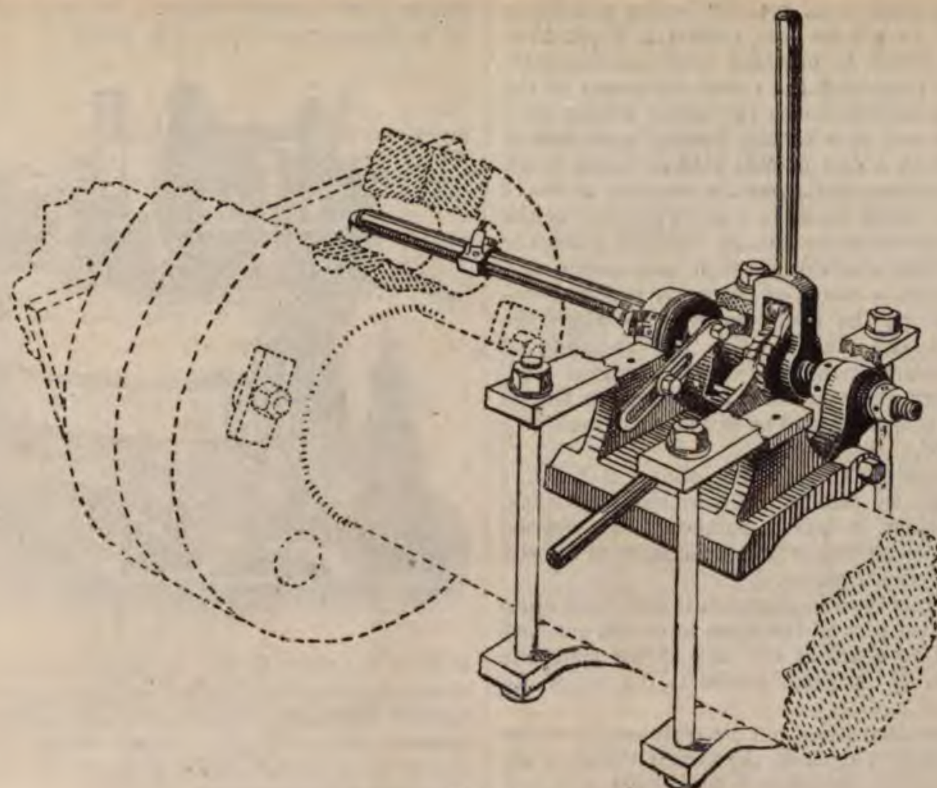


FIG. 2.

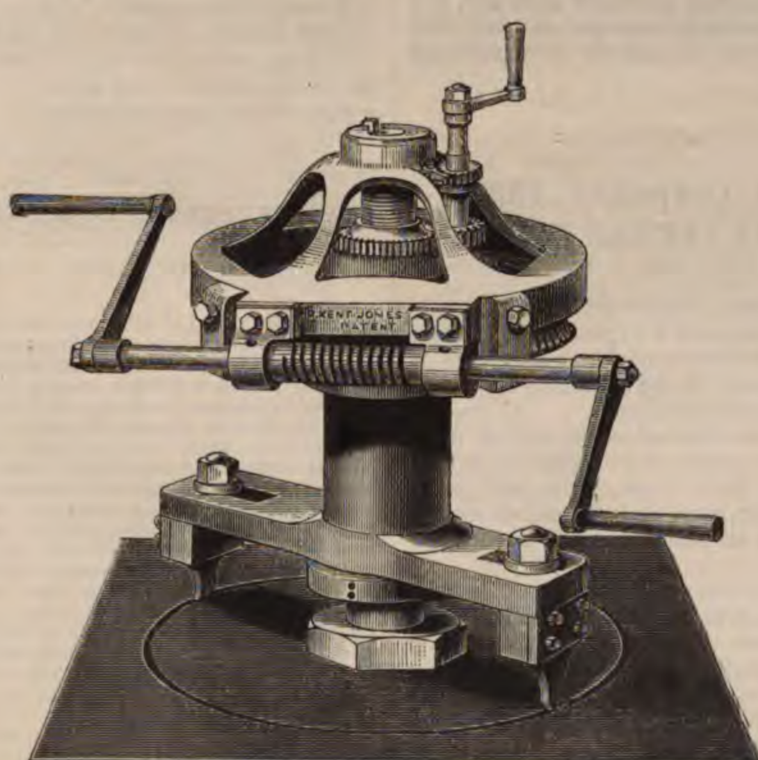


FIG. 3.

Fig. 2 shows a most useful tool for boring parallel or tapering holes. As will be seen, motion is imparted to the boring bar, which is provided with an automatic feed motion for propelling the cutter, by means of the appliance just described, hence the cutter rotates with the backward as well as with the forward movement of the handles. With a tool of this kind on board, much of the difficulty consequent upon the removal of heavy work for boring would be done away with, and as the tool is equally effective for cutting tapering holes, the angle of taper being alterable through wide limits and with great facility, a stock of rimers is rendered unnecessary. Amongst the many purposes to which the tool is applicable we may mention the re-boring of pumps, &c., without removal from the engine bed, stern tubes, rudder gudgeon holes, both holes in flanges of crank shafts, propellers, and in fact any purpose where boring is required.

The patent portable annular cutter, shown in Fig 3, is specially designed for cutting out side lights in ships, and similar openings in boilers, bulkheads, &c., and the illustration is sufficiently clear and explanatory as to need no further description from us.

As shown, the tool when in operation is fixed by drilling a hole in the centre part of the plate to be cut out, and the tool screwed by a nut at the back of the plate, the feed being given by the small handle at the top of the tool.

With this appliance holes can be truly cut in either flat, concave, or convex surfaces, the slots in the arms admitting of considerable variation in the diameters of the holes to be cut.

As will be seen from the foregoing, Mr. Kent Jones has brought out some tools which are highly suitable to the requirements of marine engineers generally, and the materials and workmanship employed in their construction fully warrants us in cordially recommending them to all our readers.

THE BRITANNIA COMPANY'S TREBLE-GEARED NAVAL PATTERN LATHE.

THE lathe we now have pleasure in bringing under the notice of our readers is a typical representative of the lathes made by the Britannia Manufacturing Co., of Colchester, at the request of the Admiralty for use on board our ironclads and torpedo ships.

As will be seen from the illustration, the tool is made exceptionally strong throughout, and to enable it to cope successfully with very heavy work, while still being driven by manual labour only, it is provided with a treble-gear arrangement in addition to the usual single and double gears.

When in double gear it takes a half-inch cut off a 2-in. or 3-in. shaft, and when running treble geared it is equal to the work required when operating on a 24-in. pump cover. Briefly, the dimensions of the tool are as follows: Centres 6 in.; bed 6 ft. by $8\frac{3}{4}$ in. on face, and 6 in. deep, and this with a gap $7\frac{1}{2}$ in. wide and 6 in. deep, will swing 2 ft. diameter. The cone has three speeds, 9 in., 6 in., and 4 in. for $1\frac{1}{2}$-in. band. The gearing is $\frac{7}{16}$ pitch, $1\frac{1}{2}$ in. face, and is altered to either single, double, or treble by means of two eccentric shafts. The steel leading screw is $1\frac{1}{2}$ in. diameter and has a $\frac{1}{4}$ in. pitch.

From the above it will be seen that the proportions observed throughout the tool are good, and the maker's name is sufficient guarantee as to the workmanship and materials employed in its construction. The tools and chucks are of corresponding strength and the weight of the whole complete is but 14 cwt.

A lathe such as this should find a place in every large steamer, where it would enable the engineers to dispense with a deal of that aid which they now generally have to seek from on shore, and in case of a break down at sea the value of such a tool is well nigh inestimable.

In going out of their regular lines to design such a tool as this, the makers have shown an enterprise which is worthy of every encouragement.

CLYDE SHIPBUILDING AND ENGINEERING

WORK DONE DURING 1885.

THE year's record of iron and steel shipbuilding on the Clyde, though, naturally, not affording matter for very profound gratification amongst thousands intimately concerned, will yet doubtless be found to be more pleasant reading than the dismal annals of Shipbuilding depression throughout the other centres. While the Clyde may have fared better than other districts in the general reign of gloom which has now lasted for the better part of 12 months, it should not be lost sight of that much of the work accomplished has be n done on disadvantageous terms, if not indeed at serious loss, simply to keep costly plant and impoverished artisans in employment. Doubtless many of the orders executed have been on account of shipowners able to invest in shipping property, having all the most modern improvements, secured at a time when labour and material have been at abnormal depths. This has been, at all events, the policy pursued in previous dull times by one or two large companies, but at the same time it may be taken as evidence of the unprecedented character of the present depression that several firms usually favoured with commissions of the above nature, have on this occassion failed to promote custom.

As it would be a somewhat fruitless task to recount the rate of production during the several months of the year, it may simply be said that the "latter end was worse than the first," and the orders which have recently been received by many firms came

literally when the point of starvation had been reached. The aggregate for the whole period amounts to *about* (we know from experience the hopelessness of seeking to obtain accuracy to within a ton or so) 193,400 tons. The number of vessels embraced in this lump figure is 241, amongst which, it may be stated, some exceedingly "small fry" are included, not a few of them being of wood. Viewing the aggregate output comparatively with that for the past few years, it is seen that (while the figures are on the descending scale they have not yet reached the depths obtaining in the dull years of 1879 and 1877, when the output was 174,700 and 169,700 tons respectively. Last year when matters were thought to be quite bad enough, in view of the high figures reached in 1881-82 and '83, the output made the comparatively respectable total of 296,800 tons, or 103,400 tons more than that of the year just gone. The position it really occupies, however, will best be seen from the following table which gives the

Yearly Output for the Last Twenty-Seven Years.

Year.	Tonnage.	Year.	Tonnage.
1885	193,458	1871	196,229
1884	296,854	1870	180,401
1883	419,664	1869	192,310
1882	391,934	1868	169,571
1881	341,022	1867	108,024
1880	241,114	1866	124,513
1879	174,750	1865	153,932
1878	222,353	1864	178,505
1877	169,710	1863	123,262
1876	174,824	1862	69,967
1875	211,824	1861	66,801
1874	262,430	1860	47,833
1873	232,926	1859	35,709
1872	230,347		

The contributions of individual firms to the general aggregate for the past year are shown in the subjoined list. The results exhibited in it bring out with great emphasis the severe nature of the depression. From several yards, which in ordinarily busy periods turned out a very considerable tonnage, the present returns are entirely *nil*, and their names consequently do not appear. Of these we may name the Govan Shipbuilding Company, of Govan; the Sandpoint Yard and the Lower Woodyard, of Dumbarton. Very many other firms usually taking rank near the head of the list, are on this occasion found about the middle and even in the lower half. Amongst the cases of this sort, we may instance as noteworthy Messrs. Aitken & Mansell, Messrs. R. Napier & Sons and the Fairfield Company, Limited. The yard of the first-named firm was closed entirely for the greater part of the year; the efforts of the second have seemingly been largely concentrated on the belted cruisers they have on hand for our Government, for which they have nothing to show in the way of output; while the capabilities of the latter company's works have not been brought into even ordinary requisition during more than five months of the twelve. The following is the list of individual firms with the number and tonnage of the vessels launched:—

	Vessels.	Tons.
Russell & Co.	28	40,866
W. Denny & Brothers	11	16,423
A. M'Millan & Son	9	13,228
Alex. Stephen & Sons	8	11,549
R. Duncan & Co.	7	10,626
Caird & Co.	3	9,329
Scott & Co. (Greenock)	6	9,156
Fairfield Company (Limited)	18	9,026
Barclay, Curle & Co. (Limited)	18	8,614
Chas. Connell & Co.	4	6,542
London & Glasgow Company (Limited)	5	5,999
J. & G. Thomson	5	5,417
W. B. Thompson	4	5,267
Wm. Simons & Co.	9	5,083
Robt. Napier & Sons	4	5,061
A. & J. Inglis	2	3,813
Lobnitz & Co.	10	3,404
D. & W. Henderson & Co.	5	3,177
Birrell, Stenhouse & Co.	2	2,824
John Reid & Co.	5	2,520
Aitken & Mansell	2	2,004
Napier, Shanks & Bell	3	1,637
Murdoch & Murray	5	1,384
Scott & Co. (Bowling)	7	1,290
Wm. Hamilton & Co.	1	1,220
Blackwood & Gordon	6	1,060
Fleming & Ferguson	4	1,030
S. M'Knight & Co.	2	956
John Fullerton & Co.	5	934
D. J. Dunlop & Co.	1	750
H. M'Intyre & Co.	3	720
Culzean Company	6	611
Campbeltown Company	1	400
Hannah, Donald & Wilson	3	336
Troon Shipbuilding Company	1	211
J. M'Arthur & Co.	5	207
W. S. Cumming	8	194
T. B. Seath & Co.	2	172
W. Swan & Co.	1	120
Ross & Duncan	8	110
Wm. Fyfe	2	90
Murray Bros.	1	75
Ardrossan Company	1	23
Totals	241	193,458

While the falling off in individual output is thus immense, and the customary order in which firms stand on the annual list as to relative output is sadly deranged, it should be mentioned that in a few cases firms have beaten their previous record. This is especially true in the case of firms who are noted for the construction of sailing vessels—a noteworthy feature of the year's work, we may say, to which special attention will be directed further on. Messrs. Russell & Co., of Port Glasgow and Greenock, for instance, who on this occasion top the list with 40,866 tons, the largest individual output yet recorded on the Clyde, are 8,000 tons in excess of their last year's figure, and the whole of their work is sailing tonnage. Messrs. A. McMillan & Sons, of Dumbarton, also have added 2,000 tons to their last year's figure, and the whole of this work is in sailing tonnage.

As a criterion on which to base the importance of individual firms or of their work, the following table, compiled from the returns of the past ten years, will be interesting. Yet tonnage is but a questionable means of gauging the importance of work done. In sailing vessels of the ordinary class the work is very slight when compared to that executed in high class mail and passenger steamers, with exquisitely furnished saloons, state rooms, powerful machinery, &c.; whilst government work, by means of the nicety with which the simplest details are carried out, represents very much more work per ton than even merchant steamers. Notwithstanding all this the table of 10 years' work subjoined is of interest, not only from the quantitative point of view, but from that of quality as well.

Abstract Showing 10 Years' Tonnage.

	Vessels.	Tons.
Fairfield Co. (Limited)	107	229,293
William Denny & Bros.	130	173,847
Russell & Co.	130	166,034
Alex. Stephen & Son	106	164,507
J. & G. Thomson	64	129,477
A. McMillan & Son	77	127,615
Barclay, Curle & Co. (Limited)	93	126,103
London & Glasgow Co. (Limited)	62	11[illegible],210
Chas. Connell & Co.	48	106,259
A. & J. Inglis	68	98,403
Caird & Co.	42	95,826
R. Napier & Sons	39	91,751
D. & W. Henderson & Co.	68	90,778
Scott & Co.	71	90,542
R. Duncan & Co.	88	77,644
Aitken & Mansel	54	70,645
Lobnitz & Co.	103	48,798
Wm. Simons & Co.	68	42,263
John Reid & Co.	51	42 088
Blackwood & Gordon	71	40,018
Wm. Hamilton & Co.	30	36,241
Murdoch & Murray	—	36,136
D. J. Dunlop & Co.	64	34,643
T. B. Seath & Co.	85	11,545
John Fullerton & Co.	43	10,463
Hannah, Donald & Wilson	51	5,993

Having now given general statistics of the tonnage produced during the year, and of the share which individual firms have had in attaining the result, it may be of interest to call attention to some noteworthy features which a closer analysis of the character of the work done reveals. A scrutiny of the returns shows that the tonnage of *steam* vessels is 89,960, while that of sailing ships

is 103,490, or over 52 per cent. of the total. This figure includes the tonnage of a number of barges and flats, which, although not coming properly under the category of sailing ships, yet fall more naturally under this head than that or steam ships. Excluding these somewhat nondescript craft, the number of sailing vessels represented in the above tonnage is 73, giving the high average of 1,400 tons for each ship. Five of the firms have their total output made up of sailing vessels, and other firms, who in ordinary brisk times never think of having to do with sailing craft, have one or more included in their output.

This matter of sailing tonnage is perhaps the most interesting, if not the most surprising feature in the returns. This marked return to the older-fashioned, but greatly more economical ocean-carrier, points, we think, to the settled conviction on the part of owners that the depression we have been experiencing is yet far from having spent its course. In times of depression, and especially with shipbuilding labour and material almost at their lowest, the politic owner has recourse to the economical sailing ship, greatly more cheap to manage; she also adapts herself more readily to the variability of the service and cargo obtainable in depressed times.

With regard to the character and size of the vessels produced, little remains to be stated. The vessels of most importance put into the water were the *Scout* and *Archer*, two of the seven twin screw torpedo cruisers being built by Messrs. J. & G. Thomson, Clydebank, for the British Government; the *Bengal*, 4,497 tons, and *Coromandel*, 4,406 tons, built by Messrs. Caird & Co., Greenock, for the Peninsular and Oriental Steam Navigation Co., and a large steel steamship of 5,500 tons and 7,000 H.P., built by the Fairfield Company, Limited, for the Norddeutschen Lloyd, Bremen. The following table exhibits the sizes of the vessels produced:—

Under 50 tons	35	Under 2,000 tons	38
,, 100 ,,	25	,, 2,500 ,,	5
,, 500 ,,	65	,, 3,000 ,,	1
,, 1,000 ,,	17	,, 4,000 ,,	6
,, 1,500 ,,	33	Above 4,000 ,,	3

For several years past that feature of the annual output of tonnage, concerned with the substitution of steel for iron, as the shipbuilding material has been regarded with special interest. The results of the work during the past year in this connection are unusually noteworthy and instructive. It is now recognised by acknowledged authorities on every hand that steel has passed beyond the experimental stage, and may be considered as having fairly entered upon its career as the staple structural material. It would be needless to quote the testimony of experts in support of this, as at almost every recent meeting of institutes connected with marine architecture and metal manufacture precise evidence of its truth has been abundantly forthcoming. So recently as September last, Mr. J. H. Biles, of Messrs. J. & G. Thomson, the eminent shipbuilders of Clydebank, summed up the testimony and arguments he submitted to the Iron and Steel Institute in favour of steel, by saying: "There does not, therefore, appear to me to be any reason, with prices as they are at present, why another iron ship should be built upon the Clyde or any other river when steel can be produced relatively as cheap as it is here." As a commentary upon this statement the results of the past year's work are certainly instructive. During that period, according to our analysis of the returns, as many as 104 vessels, aggregating 94,500 tons, have been built of steel, a tonnage equal to 48·8 per cent. of the total produced. This, as the following table will show, is an appreciable advance upon last year's result, and conclusively points to the steady growth of shipbuilding in steel:—

TABLE SHOWING PERCENTAGE OF STEEL TO TOTAL TONNAGE.

Year.	Total Tonnage.	Tonnage in Steel.	Percentage of Steel to Total Tonnage.
1879	174,750	18,000	10·3
1880	241,110	42,000	17·4
1881	341,020	66,600	19·5
1882	391,930	108,250	27·6
1883	419,660	129,650	30·9
1884	296,850	133,670	45·0
1885	193,450	94,500	48·8

This increase, we consider, is rendered the more noteworthy on account of the unprecedented depression which prevails, coupled with the fact of work in steel still being costlier than that in iron. In spite of this and the strong inducement to economy in first cost, considerably more than one-half of the vessels turned out have been built in the costlier material. Doubtless when underwriters can be prevailed upon to hold out to shipowners a reduced premium upon vessels built in steel, which in bare justice to the material should immediately be brought about, the advance in steel tonnage will be at once very marked.

Prominent amongst the patrons of mild steel for ship-building from the first, the firm of William Denny & Brothers, Dumbarton, have again this year justified by actual work the assurance with which Mr. William Denny has frequently advocated its adoption in public. Their tonnage this year, though smaller than usual, owing to the depression, consists wholly of steel, its amount being 16,430 tons, all in steamships. They have in hand, and ready for launching, a steel steamship of 5,200 tons, the largest vessel yet built in Dumbarton. As showing that in the practical introduction of mild steel the firm has taken a very large part, we may refer to a speech made by Mr. William Denny, when entertaining the members of the Iron and Steel Institute at Leven shipyard, in September of this year, in which he said, referring to the percentages of steel vessels which they had built, "In the year 1879, 57 per cent. of the vessels they had launched were of steel; in 1880, 76 per cent.; in 1881, 80 per cent.; in 1882, 72 per cent.; in 1883, 68 per cent.; and in 1884, 100 per cent." This last result has, therefore, been repeated for 1885. Continuing, Mr. Denny said, "They would notice that in the year 1883 the per centage sank to 68. That was owing to two steamers which they built for private owners being constructed of iron. They were repeats of a steamer formerly built of steel for the same owners. The result of this mistake of building in iron—and the owners had acknowledged it was a mistake—was that it would not be repeated." Messrs. Denny, we may add, have built altogether, since the advent of steel as *the* shipbuilding material about 1877 or 1878, as many as 78 vessels, of a total tonnage of over 115,000, and in this construction they have used considerably over 48,000 tons of steel.

A further noteworthy feature of the returns for 1885, still connected with steel, lies in the fact that the total output of as many as 10 firms consist wholly of steel. Besides Messrs. Denny, the firms of whom this is true are:—Messrs. Caird & Co., Scott and Co., John Elder & Co., J. & G. Thomson, Robert Napier and Sons, A. & J. Inglis, D. & W. Henderson, Aitken & Mansell, and William Hamilton & Co. Almost the whole of the above names it will be seen are those of firms usually undertaking mail and passenger steamships of the highest class.

Marine engineering is the necessary complement of steamship construction, and from information regarding the one, by easy inference knowledge can be had of the other. For this reason we have not thought it necessary to treat of marine engineering specially in this report. In next issue we propose returning to the subject of the Clyde shipbuilding during 1885, when, besides calling attention to some additional features of interest in the work done, we will refer to some features of progress in the Clyde marine engineering of 1885.

(To be continued.)

A CANAL BETWEEN THE ELBE AND THE BALTIC.

THE German Reichstag have now under consideration a Bill for the construction of a canal between the mouth of the Elbe and the Baltic, and will probably pass it without opposition. It is thought that the waterway will be commenced in a few weeks, and be completed within seven years. The North Sea and the Baltic ports of Germany will thus be brought into direct communication without the necessity of passing through foreign waters. The trade of English ports with the Baltic will also be greatly facilitated, as ships from London will save twenty-two hours in the passage, fifteen hours from Hull, eight hours from Hartlepool, six hours from Newcastle-on-Tyne, and four hours from Leith. It is thought that no less than eighteen thousand out of the thirty-five thousand now trading to the Baltic will use the canal route. It will be a great international benefit to commerce for safety as well as for time-saving.

INCREASED DIMENSIONS OF SHIP PLATES.

AMONGST other hardships which, according to a complainant in the correspondence columns of one of the Glasgow papers, shipbuilders have to endure at the hands of manufacturers, one is the well-known matter of the limits in size of steel and iron plates beyond which the shipbuilders cannot go without incurring "extra" charges. The Steel Company of Scotland is taken by this writer as representative of what is most advanced in the direction of enlarged limits, and their stipulations are given as being 20 cwt. in weight, 60 in. in breadth, 70 ft. in area, and 20 ft. long, for plates of every description. This latter limit appears to the writer to be totally inadequate, and, in order to be proportionate to the advance in other limits of steel over iron, should be at least 35 feet. The long plates required, he says, "are generally very narrow ones, such as floors, ties, keelsons, and intercostals, and do not come near the limit given for area (even at the extreme length named) so that it behoves steel makers to at once increase the limit of length in order to keep it in accord with their other limits." To this Mr. Riley, of the Steel Co. of Scotland, has replied:—"It is true that a printed list of extras has been issued by my Company, as well as by other steel makers, but it is well known to all who are practically engaged in shipbuilding, that these extras do not apply in the case of contracts for the whole of the steel required in the building of a vessel. Practically, the only limit of size in these cases is our power of production, and this is well known to, and has been fully taken advantage of by, shipbuilders, who have readily and frequently acknowledged the liberal treatment they have received in this respect."

We are in a position to support Mr. Riley's contention regarding his Company's willingness to meet the needs of shipbuilders in this respect. It is, indeed, largely owing to the readiness on the part of steel manufacturers generally to supply material of the largest sizes—which their new plant, constructed for modern needs, enables them to do—that steel has made headway so rapidly as it has done in shipbuilding. It has been frequently pointed out already, and nowhere so clearly as in the paper on "Steel Shipbuilding," read by Mr. J. H. Biles, before the Iron and Steel Institute, at its recent Glasgow meeting, that the advantageous effect of using the large plates now possible in steel manufacture, is such as will materially help steel to completely displace iron as the staple structural material. It is there stated that less weight for a given thickness is used in caps and butt straps, less rivetting is required, less scrap is produced, less time is required in construction, and less cost for labour is involved. By means of a table of figures, giving the results of careful calculation on two different types of ships, it is shown that by using steel in place of iron, there is on the total weight of plates, angles and rivets a saving, in the case of a 1,500 ton sailing ship of $13\frac{1}{2}$ per cent., and in the case of a 5,500 ton cargo passenger steamer, of 12·07 per cent. This is all on the assumption that the limits of length and breadth of the plates are the same in both kinds of material. But on the assumption that the limits of length and breadth are greater, by 2 ft. and by 6 in. respectively, than the sizes by which above results are obtained, then the percentage of reduction in total weight is 15·83 on the sailing vessel, and 13·44 on the steamer, or an increased reduction due to the increased dimensions of plates alone of 2·5 and 1·37 per cent. respectively. This evidence conclusively points to the great importance of the size of plates as a factor in the future success of steel shipbuilding. Shipbuilders generally, however, have not as yet given any very decided answer to the appeal which has sometimes been made to them to state what it is exactly they consider satisfaction in the matter of ship-plate dimensions. Mr. E. Windsor Richards, in the discussion on Mr. Biles' paper, above referred to, said he would be very glad to be informed what was the largest size of plates which could be conveniently dealt with in a shipyard. He saw no difficulty, he said, in producing steel plates 50 ft. to 60 ft. long by 5 ft. wide, or even larger if required. Referring to this, Mr. Biles replied that he had used plates $\frac{5}{16}$ in. and $\frac{3}{8}$ in. thick up to 16 ft. long by 5 ft. wide. These large plates were used on a small ship, and involved the maximum difficulty in curving. He considered that plates up to 24 ft. long by 7 ft. 6 in. wide could be conveniently employed on large ships if shipbuilders would alter their plant. For deck plating the only limit would be the depth of gap in the punching machines and the power of the lifting appliances. In the yard with which he was connected—Messrs. J. & G. Thomson, Clydebank—they had punching machines with 36 in. depth of gap, so that they could punch all the holes in plates up to 6 ft. wide. For wider plates some holes in the centre would have to be drilled, but the extra cost of this would be more than compensated by the other savings resulting from the use of wider plates.

Throughout shipyards generally the standard working length for merchant ship plates is at present 16 ft., while in very many cases—especially where iron is still largely used—14 ft. is the customary length adopted. Plates of greater length than 16 ft. have seldom been used except in cases where, in order to obtain a good shift of butts throughout, or to save a butt near the termination of the strakes, 18 ft. or even longer plates have been employed. This length, however, is not possible to those plates amidships, bilge or otherwise, having considerable and uniform curvature, simply because of the limited size of the rolls with which shipyards, even the best appointed, are provided.

A very noteworthy advance in the above almost universal practice at present obtains, we understand, in the Barrow Shipbuilding Company's Works, where, on a large steamship for the Pacific Company, the average length of steel plates is 20 ft., while some of them are 22 ft. and even 24 ft. long. The rolling plant of the Barrow Company is of course adequate to the demand thus made upon it for increased length of plate, and the near future will doubtless see this enhanced feature in the working capability of shipyard plant copied elsewhere.

NEW WAR SHIPS.

SINCE the present Administration came into power, fifteen additional ships and craft have been ordered for the Navy. Two of these, the *Trafalgar* and *Nile*, are to be ironclads of 11,930 tons displacement. Their estimated speed is to be 16 knots; but are only to have a coal carrying capacity of 1,200 tons. They are to be armour-plated with steel, with a thickness 20 in. on the side, and 18 in. in the turrets. Their armament will consist of 12 guns $\left\{\begin{array}{l}\text{4 66-ton B. L.}\\ \text{8 5-in. B. L.}\end{array}\right\}$ The former-named ship will be built at Portsmouth, and the latter at Pembroke. Two additional belted cruisers of an improved *Mersey* type, to be called the *Aurora* and *Immortalité*, similar to the five ordered at the beginning of 1885, are to be constructed. They will be steel armoured 10 in. thick on the side, and 16 in. at the ends of belt. They will be armed with 12 guns $\left\{\begin{array}{l}\text{2 92-in. B. L.}\\ \text{10 6-in. B. L.}\end{array}\right\}$ Their displacement will be 5,000 tons, while their speed will be increased to 18 knots. Their coal carrying capacity will not be more than 900 tons. Four composite gunboats, the *Rattler*, *Wasp*, *Lizard*, and *Bramble*, with an armament of 6 4-in. B. L. V. C. P. guns, are to be built by contract. Two of which will be constructed at Elswick by Armstrong & Co., and two at Belfast by Harland and Wolff. Their displacement will be 670 tons, and each will have a coal carrying capacity of 105 tons of coal, and 95 tons of patent fuel. The speed of the *Rattler* is to be $13\frac{3}{4}$ knots, and of the other three 13 knots. Two steel torpedo-cruisers of 1,630 tons displacement, a speed of 16 knots, and a fuel endurance of 475 tons, are to be built at Devonport. They will be christened the *Serpent* and *Racoon*, and will be armed with 10 torpedo tubes, 6 6-in. V. C. P. guns, and 8 1-in. Nordenfelts. The *Buzzard*, a composite gun vessel, with an armament of 8 5-in. B. L. guns, is to be constructed at Sheerness. She is to be provided with a speed of 15 knots, a fuel carrying capacity of 166 tons of coal, and 114 tons of patent fuel, and a displacement of 1,040 tons. The list is completed by four torpedo gunboats, the *Grasshopper*, *Spider*, *Sandfly*, and one not yet named, of 450 tons displacement, and 100 tons coal-carrying capacity, and 19 knots speed. They will each be armed with 4 torpedo tubes, 1 4-in. B. L. gun, and 6 3-pr. Q. F. guns. The first mentioned will be built at Sheerness, the next two at Devonport, and the last by contract.

A LARGE torpedo boat, 125 ft. long, having rotating conning towers, to each of which is attached a couple of Whiteheads, and built by Messrs. Thorneycroft & Co., was tried at Portsmouth on December 14th. Some slight defect in the steering gear, which caused her double rudder to jam, arrested the trial for endurance, but the runs on the measured mile were completed, the mean of six giving the speed of 20·9 knots per hour. As soon as the defect has been remedied, the boat will be driven continuously for six hours for the purpose of ascertaining the amount of fuel consumed per hour with the engines working at full power.

SHIPBUILDING ON THE NORTH-EAST COAST IN 1885.

THE year which has now drawn to a close has been, like the greater part of its predecessor, a dull and trying one for shipbuilders and marine engineers. Most of the yards and workshops on this coast, have, however, been a little better employed during 1885 than during the last six months of 1884, when several of them were closed altogether. This applies, of course, mostly to the shipyards, and unfortunately some of them are in the same condition at present, and we think we may safely say that none of them have been more than half employed. A common sight throughout the year has been yards with half of their "berths" unoccupied, while others were only occupied by vessels which had been long ready for launching.

As might have been expected with the large fleet of steamers "laid-up," the greatest falling off has been in the building of cargo steamers, while the greatest demand has been for vessels specially adapted to certain trades, to replace losses, to meet increasing demands, or to enable their owners to compete with the more modern vessels of other firms. At the same time, however, the more wealthy and enterprising owners in the general carrying trades have taken advantage of the exceedingly low prices prevailing to provide themselves with new ships of large carrying power with all the most modern improvements, both in ship and machinery, for economical working. Most of these have been fitted with triple expansion engines which enable them to attain a good speed on a very small consumption. These vessels can hardly fail to be profitable to their owners when freights rise to anything like payable rates, but it must be admitted that they must, by their large carrying capacity, delay that very desirable period considerably. They will prove very formidable competitors to the older and smaller class of vessels. The north-east coast has had a rather better share than usual in the building of large sailing ships during the year. There has also been a fair share of the best class of shipbuilding done in this district. Two of the steamers built by Messrs. Swan & Hunter, at Wallsend, for example, were very handsomely fitted out with teak upper decks, encaustic tiles throughout passenger accommodation, electric lights, &c. These were the steamers *Burrumbeet* and *Corangamite*, built for Messrs. Huddart, Parker & Co.'s trade between Melbourne, Victoria, and Sydney and Newcastle, N.S.W. We have been informed that these vessels are now running in that trade. Five of the steamers built by this firm are of steel, and the same number have triple expansion engines.

To come more particularly to the year's output, we find that of the Tyne to be, as registered up to the latter end of December, 49 vessels, having an aggregate tonnage of about 63,000 tons. To this, however, must be added several vessels of various sizes and types for our own and foreign governments which have been in course of construction during the whole or great part of the year. On the Tees there has been 38 vessels registered, of a gross tonnage of about 25,000 tons. The Wear has registered 31 vessels of about 41,000 tons, and 9 vessels of which we have not received the tonnage. The Hartlepools have turned out 18 vessels, of 33,012 tons, 14 of which are steamers, the aggregate horse power being 2,530. The registered tonnage of the whole district, from the Tees to Blyth, may be taken at 163,200 tons, while there remains a number of ships, not included in this calculation, which will probably make up the total to 185,000 tons. A fair proportion of these are built of steel, as will be seen by the list. When it is remembered that the Wear alone produced in 1883 upwards of 212,000 tons, the present state of the trade cannot be said to be one of prosperity. While a good number of sailing vessels have been built during the year, marine engineers have had some compensation from a few steamers having new boilers fitted to work at a high pressure, and the engines converted to the triple expansion principle. We notice, however, that the number of steamers laid aside for want of employment has very considerably diminished during the year, and we may fairly hope that the worst is over and a more prosperous time at hand.

THE Secretary of the United States Navy, in his report to Congress, urges the building of new cruisers. It is believed that the Democratic policy will be in future directed to the enlargement of the Navy, which hitherto many of the Democrats have opposed, chiefly because the Government was under Republican control.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—In our last month's report we stated that Messrs. Armstrong, Mitchell & Co.'s shipyard at Low Walker would shortly have to be closed unless some orders were obtained. We are now in a position to state that the firm have obtained an order for three steel steamers of good size, to be laid down at this establishment, and the preliminary work in connection with them has been commenced. The Elswick yard belonging to the firm is now the busiest establishment on the Tyne. The ironclad ordered by the Admiralty is now sufficiently advanced to admit of a large force of men being engaged on it, and as there are half a dozen other vessels in various stages of progress, the aggregate number of men employed is very much larger than at any time since the commencement of operations, eighteen months ago. To give an idea of the great pressure of work at this concern just now, it may be stated that the delivery of material goes on uninterruptedly, there being two sets of men engaged, one working by night and the other by day. The new marine fitting shops lately erected by this firm will shortly be in full operation, and in the meantime all the existing departments are as busy as possible, the ordnance shops being especially glutted with work. Messrs. Dobson & Co., shipbuilders, Low Walker, have three large vessels on the stocks, one of which is in frame and one in an early stage of plating. The third is on the framing stage, and from the peculiarity of construction is evidently intended for the oil trade. This, we believe, is the first vessel of the kind that has been laid down on the Tyne, and it will be succeeded on the same stocks by others of a similar type. Messrs. Hawthorn, Leslie & Co. have been entrusted with another order from the Admiralty, namely for a small steamer to carry stores, &c. It is understood that the firm are negotiating for some foreign contracts, and next year is expected to be a busy one in the shipbuilding department. The firm are making important extensions at their marine engine works, St. Peters. Messrs. Swan & Hunter have been doing very little lately, but they have just commenced frame turning for a large vessel, and it is understood that other work is forthcoming. Messrs. Palmer have four vessels in early stages, besides the two "belted cruisers," which are now plated up to the protective deck. This firm, although they made a nominal profit last year (taking the whole of the operations into account) were unable to declare a dividend, there having been a loss of over £12,000 on three steamers contracted for in that period; but at the present moment appearances greatly favour the idea that the shareholders will be better dealt with on the occasion of the next squaring up. The new steel works have been started, but up to the present the work done has been mainly of an experimental kind. Messrs. Edwards, whose yard has been closed for some time, have just recommenced operations on a small scale. The keel for a "hopper" barge has been laid, and it is understood that the firm have two or three others to build. Messrs. Readhead, who had but one vessel on the stocks last month, have now a second berth occupied. There are still six yards closed on the river, but it is probable that one or two of them will be re-opened early in the year. At most of the marine engine works great slackness is still the feature, and both foundries and forges continue to be, with few exceptions, very short of work. Messrs. Clark, Chapman & Co.'s factory, Gateshead, where steam winches are the principal articles of manufacture, is getting busier; but orders must become much more plentiful than they are at present, before the extensive resources of the establishment can be fully utilised. Messrs. Carrick & Wardale's establishment is kept steadily going, the specialities of the firm being in fair demand, considering the very general depression existing. Chain and anchor factories are still almost absolutely without work, and rope works are distinctly less active than they were at the beginning of the year 1884.

The Wear.—Since last month Messrs. Short Brothers have got an order for a couple of large steamers, one of which is now being laid down. The Sunderland Shipbuilding Company have also been commissioned to build two vessels of medium size, and the construction of the first is being proceeded with. The Strand Shipbuilding Company is a third firm who have been lucky enough to secure an order, and in this case the vessel, which is for a French Company and is to be built partly of iron and partly of steel, will be laid down at once. Messrs. Bertram & Haswell's yard, which has been closed for more than a year, will be re-opened immediately after the new year holidays. The firm obtained an order some time ago, but there was no pressure for early delivery, and hence

the delay in commencing operations. Two yards on the Wear have been closed within the month, making in all eight establishments that have their machinery standing. Messrs. J. L. Thompson & Sons have just started a new frame furnace, which is heated by gas. The great advantage of this arrangement is that the heat can be regulated in the furnace, so as to be concentrated at either end or in the middle, to suit the requirements of the material undergoing the heating process. A patent bevelling machine has been placed in front of the furnace, and other steps have been taken to facilitate the work of frame-turning. In connection with the marine engineering trade of the district an important incident has taken place during the month, namely, the formal closing of the fitters' strike. It had lasted nearly two years and a half, and had cost the Engineers' Society over £30,000. After the prolonged struggle, and the lavish expenditure of union funds, the men had to submit unconditionally, and they would now be very glad to get back to their work, but unfortunately there is none for them to do. One or two firms have certainly increased the work upon their order books, but none of them are anything like busy, and a very large addition to the work in hand will have to take place before many of the strike hands can be reinstated in employment.

Review.

Modern Shipbuilding and the Men engaged in it. By Daniel Pollock. London: E. & F. N. Spon.

This is certainly one of the most interesting books that has ever fallen into our hands, whether regarded from a general reader's point of view or looked at in a purely professional light.

In publishing this work the author's object has been to supply in a popular and yet trustworthy manner, and in a form which shall be at once handy and accessible, an historical epitome of that great activity and substantial progress in the science and practice of both shipbuilding and marine engineering which has left so indelible a mark on the records of the last few years. When we remember that during these few eventful years the ship and engine builders have honourably vied with each other in keeping pace with the extraordinary demands made upon them for increased tonnage and horse power, and having also in mind the rapid strides made in both departments, and the ever increasing tendency to further complexity in both vessels and engines, we cannot but congratulate the author upon the very able and satisfactory manner in which he has accomplished his object, and with it the by no means easy task set before him, a task, we regret to say, rendered all the more difficult (and we can only imagine it has been done quite unthinkingly) by the reluctance of several eminent representatives of the kindred sciences to the publication of their portraits, or any notes of their personal achievements. In so comprehensive and vast a subject as modern shipbuilding, it was necessary to keep the volume within ordinary limits, that the author should somewhat curtail his field of review, and this he has judiciously done by confining himself to the doings of the merchant marine. In addition to an admirable series of portraits and biographical notes of more than a dozen of our leading engineers, builders, etc.—and from personal knowledge we can vouch for the life-like fidelity of nearly all the portraits—the work contains many tables and diagrams that must prove of interest to all concerned in shipping.

Perhaps not the least interesting table in the book is the somewhat lengthy list of steamships above 4,000 tons gross register, arranged in the order of their tonnage, and showing builders' dimensions, material employed in construction, names of owners and builders, date of building and where built. This list embraces the names of 138 vessels, and serves to enhance the value of a thoroughly readable and interesting book.

On December 11th the fourth of the twenty-four torpedo boats building by Yarrow & Co. for the English Navy was tested on the Thames in the presence of the Admiralty and Portsmouth authorities, when a speed of 19¾ knots during two hours' continuous running was obtained, the boat being loaded according to the Admiralty conditions. These torpedo boats are 125 ft. long, and were ordered last spring.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—Ed. M. E.]

THE ALMQUIST MARINE ENGINE GOVERNOR.

To the Editor of The Marine Engineer.

Sir,—Referring to your illustrated notice of the "Almquist Marine Engine Governor," which appeared in the last issue of your valuable journal, I beg you will kindly allow me to call your attention to paragraphs five and eight. In the first-mentioned you say, "The larger or governing one actuates, by means of its piston, the throttle valve of the main engines, and also a piston valve connecting the 'receive' in the condenser, and by thus causing a vacuum on both sides of the low pressure piston the governor serves to deaden the force of the large as well as the small cylinder;" and at the conclusion of the latter paragraph referred to you say, "And here we may state that Mr. Almquist has foreseen the emergencies when an anticipating governor is wanted, and gains this point by adding a supplementary valve, which is acted on by the water pressure outside the stern of the vessel."

In *Engineering* of 16th October last is an illustrated notice of this governor, in which no reference is made to either a piston valve in connection with the low pressure cylinder and the condenser, or to a supplementary cock or valve and pipe connection with the stern of the vessel. In the following week's issue appears a letter from Mr. Almquist, of which the following is a copy:—

"Sir,—I beg to correct a misstatement in the last number of your paper (page 366) in which you say that I am engaged in the Swedish Navy. For the present I am not on the active list. At the same time I beg to draw your attention to two points not mentioned in your note. The governor is not only connected with the throttle valve but also with a piston valve, which permits the steam in the receiver to escape to the condenser. By this arrangement vacuum will be obtained on both sides of the piston of the low pressure cylinder, which thus loses all its power in an instant (if so required). In some cases it is required to have the governor 'anticipating,' and when so, there is fitted between the outlet and inlet pipes of the little pump a supplementary cock, governed by the water pressure at the stern of the vessel.

"I am, Sir, yours truly,

"Fridolf Freson Almquist,

"Seagoing Engineer.

"Stockholm, Sweden, *October* 19*th*, 1885."

This communication was met by me in the following reply, and which appears in *Engineering* of November 6th, and of which up to the present date no notice whatever has been taken by Mr. Almquist:—

"Sir,—My attention has just been directed to a letter on the above subject in your issue of the 23rd ult. from Mr. Almquist, and which to my mind is somewhat misleading, because Mr. Almquist says, "The governor is not only connected with the throttle valve, but also with a piston valve, which permits the steam in the receiver to escape to the 'condenser.'" Now, if Mr. Almquist will refer to the specification of his application for patent dated October 25th, 1884, No. 14,416, I challenge him to put his finger on any sentence which would substantiate the statement above made, in spite of the ambiguous language in which the specification is framed. On the other hand, Mr. Almquist says, page 3, line 32, "In large engines with heavy valves a special arrangement is made, whereby the steam closes the throttle valve, the governor regulating the extent it shall open or close." There is, in fact, no indication whatever to show that there is a piston valve to permit the steam in the receiver to escape to the condenser. Neither is there any reference in the specification aforesaid to the supplementary cock; and as to his cataract it is intended to be in the engine room, and, indeed, he says so, when he refers to the direct connection between piston

rod of same and governor. How then could it be properly influenced by the water at the stern of the vessel, seeing that it is nearly amidships? Such an arrangement can only be effective at the stern of the vessel, and seeing that he has no such arrangement included in his specification, nor, indeed, the piston valve referred to, it is perfectly clear to my mind that these arrangements are after thoughts of Mr. Almquist.

"I am, Sir, yours, &c.,
"C. Burnett.

"Hartlepool, *November 3rd*, 1885."

I have per same post instructed my agents to hand you copies of both specifications for comparison and reference, and feel sure that at sight of same you will do me the justice to explain my true position in the matter.

I am, Sir, yours truly,
Hartlepool, *December 21st*, 1885. C. BURNETT.

THE STRIKE IN THE ENGINEERING TRADE OF SUNDERLAND.

To the Editor of The Marine Engineer.

Sir,—I am instructed by the Engineering Employers of Sunderland to send you the Circular enclosed herewith for insertion in your valuable paper as soon as your space will permit.

The true position of the parties at the termination of this dispute will be obvious after perusal of the circular and the copy of correspondence attached thereto. As will appear, it was primarily intended for distribution amongst employers of engineering labour in the kingdom; but my clients also deem its free publication in the press of importance, inasmuch as many distorted versions of the matter have, during the last few days, appeared in the London and Provincial newspapers and journals.

I am, Sir, your obedient Servant,
JOHN HASWELL, Secretary.
6, Fawcett Street, Sunderland, *8th December*, 1885.

"*Re* ENGINEERS' STRIKE.

"Gentlemen,—I am instructed by the engineering employers of this town to enclose you copy of correspondence, from which you will see that the Local District Committee of the Amalgamated Society of Engineers has unconditionally withdrawn the circular of demands issued by them in June, 1883, and that therefore the strike of which I gave you notice is at an end. Should you have considered this strike a bar to the employment of the men you will see that it is now removed.

"Further, I am requested to convey to you the thanks of the Sunderland employers for any assistance you may have rendered them. "Yours truly,
"JOHN HASWELL, Secretary.
"6, Fawcett Street, Sunderland.
"*3rd December*, 1885."

"Sir,—I am instructed by this Committee to inform you that the Strike Circular of June, 1883, is withdrawn by us from this 28th day of November, 1885, and we trust you will notify the other employers throughout the country that the Strike is at an end.

"(*Signed*) S. MURGATROYD, Secretary.
"*Local District Committee, Amalgamated Society of Engineers, &c.,*
"*Sunderland, 28th November*, 1885.
"*To* J. Haswell, Esq."

"Dear Sir,—I received your letter of the 28th ult., yesterday afternoon, and observe that you have ended this dispute by the unconditional withdrawal of the Circular of demands issued by your Society in June, 1883.

"I have pleasure in enclosing you copy of a Circular which I have been instructed to distribute amongst the Employers of the country, announcing the conclusion of the Strike.

"As an additional means of making the settlement widely known I also send a copy of this Circular to the press.

"(*Signed*) JOHN HASWELL.
"6, Fawcett Street, Sunderland, *3rd December*, 1885.
"*To* Mr. S. Murgatroyd, Sec. Amalgamated Society."

THE POSITION OF MARINE ENGINEERS.

To the Editor of The Marine Engineer.

Sir,—The business-like suggestion made by "An Old Chief" in your November issue, that instead of merely repeating what our grievances are, we should discuss the "causes that have produced these grievances," and the best means of remedying them, is, I think, most valuable, and in that way I will endeavour to deal with one part of the subject.

Firemen going to sea as engineers do us much harm, and it is well worth our while to consider how they get into that position. In doing this we must not forget that in most cases where a man has been taken "off the fires into the engine-room" it has been done by the chief engineer of the ship he was in, whose reason for so doing has very often been the difficulty experienced—especially when trade is brisk—in getting steady reliable men as assistant engineers. This difficulty is mainly due to a class of men who are found in all large sea-ports, of irregular and dissipated habits. They will neither stop ashore nor go regularly to sea, who, if they get over a few months in a ship without being discharged for misconduct, seem to make it a rule to leave, often when it is most inconvenient to get any one else. Numbers of the class I allude to may be found in our principal ports loafing about, or getting an odd day's work in the repairing shops. Few of them have certificates, but some of them have been in as many as twenty different ships, and averaged perhaps three months in each. Now, it is not surprising that many a chief rather than be troubled with such wasters, or, perhaps, almost forced to do it by one of them clearing out when his ship was ready for sea, has taken his leading fireman, who may have been with him for years, into the engine-room, certain that at any rate he would be sober, and there when wanted. I mention this not to excuse chief engineers for doing it, but to show the need there is for great care in choosing their assistants. I would also suggest the formation of a register, to which the names of only those who are of first-rate character and practical mechanics should be admitted. It might also be useful to require that they should have been a certain length of time in and have satisfactory reasons for leaving their last ship; but I hope other of your readers will give their opinions on this proposal.

Before any improvement can be effected in our position we must get clear of the idea which some of your correspondents have, that we are a set of injured innocents, who are illused without any cause, and study how to improve ourselves and our class in every way, so as to become worthy of a really high standing, which will be obtained not so much by calling on the Board of Trade to help us, as by an earnest endeavour on our own part to fulfil our duties in the best possible way.

Yours respectfully,
Hartlepool, *December 12th*, 1885. I.H.P.

FIRST COMPOUND CONDENSING ENGINES FOR ATLANTIC STEAMERS.

To the Editor of The Marine Engineer.

Sir,—In reply to your question in issue of 1st current, I believe the Anchor Line screw steamer *India* was the first steamer fitted with Compound Surface Condensing Engines that crossed the Atlantic.

The vessel was built and engined by Wm. Simons & Co., Renfrew, in 1866-7, and when launched was named the *Queen of the Belgians.*

The following are the names of the officers during the first trip to New York:—R. P. Munro, Master; A. Sinclair, 1st Engineer; W. Miller, 3rd Engineer; Rob Robertson, 4th Engineer.

Yours truly,
WILLIAM BROWN.

P.S.—I fail to remember the 2nd Engineer's name.
Renfrew, *December* 22.

The *Polyphemus*, torpedo ram, Commander Gallwey, has completed her torpedo and machine and rapid-firing gun trials at Portland.

Messrs. Yarrow & Co., of Poplar, have received an order from the Italian Government for a launch, to be propelled by electricity, for Spezzia dockyard, where it will be tested especially with a view of determining the merits of this system of propulsion for torpedo boats.

We understand, says the *Times*, that Mr. W. H. White, Director of Naval Construction at the Admiralty, will, under the new organisation scheme, combine with his present office that of Assistant Controller of the Navy. Professional assistants are also to be appointed to the Admiral Superintendents at Portsmouth, Chatham, and Devonport.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—ED. M. E.]

LAUNCHES.—ENGLISH.

Preston.—On November 24th Messrs. M. Pearse & Co. launched from their iron shipbuilding yard at Stockton-on-Tees an iron screw steamer of the following dimensions:—Length between perpendiculars, 275 ft.; breadth extreme, 37 ft. 2 in.; depth of hold to top of floors, 19 ft. 11 in. She will be classed 100 A1 at Lloyd's, and has been built to the order of Messrs. R. Ropner & Co., of West Hartlepool. Her engines are by Messrs. Blair & Co. (Limited), of Stockton, and are on the triple expansion principle. As she left the ways the name of *Preston* was given to her by Miss Appleton, of Woodside.

Screw Tug.—On November 25th, at the Usk Shipbuilding Company's yard, Newport, was launched a screw tug, 110 ft. long, 19 ft. 6 in. beam, and 11ft. 3 in. depth of hold. She is to be fitted with triple expansion engines, with 25 in. stroke designed by Mr. Pollock, Fenchurch-street, London, and built by Messrs. Newall & Co., Bristol. The vessel has been constructed under the superintendence of Mr. J. C. Stephens, on behalf of the owners, Messrs. Watkins & Co., London. The boat was launched by Miss Stevens, daughter of Mr. A. J. Stevens, J.P., and was towed into the Alexander Dock for completion.

Medusa.—On November 26th there was launched from the shipbuilding and engineering works of Messrs. W. H. Potter and Sons, of Liverpool, an iron screw steamer of the following dimensions, viz.:—Length 240 ft.; beam, 34 ft.; depth, 16 ft.; tonnage b.m., 1,350 tons. The vessel was named the *Medusa* by Mrs. Alfred Holt. The *Medusa* has been built to the order of Mr. Alfred Holt, and is a duplicate of the *Hecate* (s), launched from Messrs. Potter's works in August last for the same owner. The *Medusa* is intended for the China coasting trade, will have compound surface-condensing engines of the most approved type, and is fitted with all the most recent appliances for working vessel and cargo, including steam winches, steam pumps and steam windlass.

Crab.—Messrs. William Gray & Co., of the West Hartlepool shipyard, have launched an iron screw steamer of 280 ft. length, 27 ft. beam, and 18 ft. 6 in. depth of hold. She is constructed of steel, and will carry 2,650 tons, and was built to the order of the Cork Steamship Company, and classed 100 A1 at Lloyd's. She was christened the *Crab* by Mrs. Mudd, of Hartlepool.

Grand Canto.—On December 3rd Messrs. D. Allan & Co., Granton, launched a screw steam trawler, a vessel measuring 86 ft. by 17 ft., by 8 ft. 5 in., and named the *Grand Canto*. She is owned by Messrs. Nefarrate Mendzoto & Co., a Spanish firm, and is intended for trawling off the coast of Spain. Her engines, which are of 35 N.H.P., are being supplied by Messrs. Hutson & Corbett, Glasgow.

Kesteven and Lindsey.—On December 5th two iron steam fishing vessels, built to the order of the Boston Steam Fishing Company (manager, Mr. A. W. Ansell), were launched from Earle's Shipbuilding and Engineering Company's Yard, Hull. The vessels, named respectively the *Kesteven* and *Lindsey*, are sister ships to the *Witham* and *Holland*, sent from the slips three weeks previous. Their dimensions are:—Length, 100 ft.; breadth, 20 ft.; depth of hold, 10 ft. 6 in. They have raised quarter-decks aft, and half-forecastle forward. They are built to Lloyd's 100 A1 class, and have extra strength at the sides, for protection against chafing, to which vessels of this class are a good deal liable. The engines and boilers are placed aft, and the space between these and the forecastle deck is wholly utilised for fish and ice room. The accommodation for captain and officers is under the quarter deck, and that of the crew the forecastle. The engine and boiler hatches are enclosed by strong casings, entirely of iron, with a view to making this part additionally secure in bad weather. They will be fitted by the builders with their triple compound three-crank engines, having cylinders 11½ in., 17 in., and 30 in. diameter, and 21 in. stroke, which will be supplied with steam at 150 lbs. pressure, from a steel boiler, fitted with two of Fox's corrugated furnaces. A powerful steam-winch, of Earle's special design and make, will be fixed on their deck for working the trawl gear, and adapted also for taking the anchor on board. The ceremony of christening the *Kesteven* was performed by Miss Pauling, and of the *Lindsey* by Mrs. A. Shaw, of the Boulevard, Hull.

Young Donald.—On December 7th there was launched from the yard of Messrs. Winlo Brothers, South Shields, a screw fishing vessel of the following dimensions:—Length over all, 74 ft.; breadth, 16 ft. 8 in.; depth, 9 ft.; 100 tons b.m. She is built to the order of Mr. J. M. Scott, Sunderland, and will be engined by Mr. J. Wigham, Hylton, with engines of 20 H.P. On leaving the ways she was christened the *Young Donald* by Miss M'Donald, of Sunderland.

Flora.—On December 7th Messrs. Wigham, Richardson and Co. launched from their Neptune Works a screw steamer, for service in the Black Sea. Her dimensions are as follow:—Length between perpendiculars, 189 ft.; breadth of beam, 29 ft.; depth 14 ft. As she left her berth in the builders' yard she was christened the *Flora* by Miss Christie, of Tynemouth, daughter of one of the builders. The *Flora*, like her sister ship, the *Neptune*, has been built for Mr. Leon Brodsky, of Odessa, sugar exporter, and the boiler of the *Flora* has been specially designed for burning oil instead of coal. Immediately after the launch the vessel was taken under the builders' shearlegs for her machinery.

Blackcock.—On December 8 a screw tug steamer, named the *Blackcock*, built to the order of the Liverpool Screw Towing and Lighterage Company, was launched by Messrs. Laird Brothers, of Birkenhead, and christened by Mrs. Hill, wife of Mr. W. Becket Hill, Managing Director of the company. The *Blackcock* is about 150 ft. in length by 22 ft. beam, and 350 tons o.m., and she will be fitted with a set of powerful triple expansion engines, which have been made by Messrs. Laird, and are now nearly ready to go on board.

Thames.—On December 10th the twin-screw protected corvette *Thames* was launched at Pembroke Dockyard. The *Thames* is of the *Leander* and *Amphion* class. Her length is 300 ft.; beam, 46 ft.; displacement, 3,500 tons. The vessel is constructed entirely of steel, and when completed ready for use she will draw 16 ft. of water forward and 20 ft. aft. She will be propelled by twin screws driven by compound engines with surface-condensers. The contractors for the engines are Messrs. J. Penn & Son, of Greenwich. The indicated force with common draught will be 3,800 H.P., with forced draught 5,700 H.P., and the estimated speed is 17 knots per hour. The *Thames* will have a coal-carrying capacity of 750 tons. The armament will consist of two 8 in. guns mounted on Vavasseur central pivot mountings, six 6 in. similarly mounted, six 6 in. broadside, three 6-pounder quick-firing guns, six 1 in. four-barrel Nordenfelt guns, two 0.45 in. five-barrel Gardner guns, 18 Whitehead torpedoes. The vessel will be fitted with two electric search lights. Her total cost will be £153,500. As soon as she is ready for sea the *Thames* will be brought round to be completed in her fittings at Devonport, and she will then receive her armament. She will be rigged as a schooner.

Toxteth.—On December 10th there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt and Co., at Southampton, an iron sailing ship, of 2,150 tons net register, and of the following dimensions: Length, extreme, about 280 ft.; breadth, 40 ft. 6 in.; depth of hold, 24 ft. 8 in. The vessel is built in excess of Lloyd's highest class. She is full rigged and fitted with skysail on mainmast. Accommodation is provided in full poop for captain and officers, while petty officers and crew are berthed in an iron deckhouse amidships. She is fitted with Harfield's patent combined capstan windlass for working anchors and chains. She has been built under the superintendence of Captain Charles Semple, of Liverpool. On the vessel leaving the ways she was christened by Miss Zina Methven, of Woolston.

Cabo Santa Maria.—On December 21st there was launched from Messrs. Raylton, Dixon & Co.'s Cleveland Dockyard, Middlesbrough, a small iron screw steamer, 105 ft. long, by 19 ft. beam by 8 ft. 6 in. depth of hold. The engines, which are compound surface condensing, will be supplied by Messrs. J. P.

Rennoldson & Son, of South Shields, the diameter of cylinders being 14 in. and 25 in. by 18 in. stroke. She has been built to the order of foreign owners, and on leaving the ways she was christened *Cabo Santa Maria*. She is fitted with Emerson, Walker & Thompson Brothers', Limited, patent windlass.

LAUNCHES—Scotch.

Hopper Dredger.—On November 23rd Messrs. Fleming and Ferguson, Paisley, launched a large hopper dredger for the Auckland Harbour Board, New Zealand. The dimensions of hull are 172 ft. by 32 ft. by 14 ft., and the carrying capacity of hoppers is 600 tons. She is capable of dredging 400 tons of clay or gravel from a depth of 30 ft., and will steam at a speed of 8 knots per hour. She is fitted with all the latest improvements in hopper dredgers, and has triple-power three-barrel independent steam winches fore and aft. Hoisting gear for lowering and raising bucket ladder is also driven by pair of independent auxiliary engines. The raising of the hopper doors is also done by separate independent engines, by which they can all be closed tight in five minutes from time of discharging. The vessel is self-propelling, being driven by steel twin-screws, having clutches for disconnecting. Her main engines consist of two pairs of independent surface-condensing engines, to indicate 600 H.P. Gearing throughout the vessel is of cast steel, and the machinery generally is similar to that lately fitted by Messrs. Fleming and Ferguson on board the hopper dredger for Ayr harbour, and which vessel is doing her dredging and discharging at the unprecedentedly low cost of a penny per ton. During construction she has been under the supervision of Mr. John Darling, who represents the Auckland Harbour Board in this country.

Curlew.—On November 28th the Campbeltown Shipbuilding Company launched from their yard at Trench Point, Campbeltown, a screw steamer named the *Curlew*, of about 400 tons d.w., dimensions being 142 b.p. by 23 by 11. This vessel has been built for the trade between Channel Islands and English Channel ports, to the highest class at Lloyd's, under special survey, has every facility for speedy loading and discharging of cargo, and is to be fitted with triple expansion engines of about 400 I.H.P.

Don.—On December 5th Messrs. Russell & Co. launched at Port Glasgow an iron barque of 1,115 tons nett. Her principal dimensions are:—Length, 215 ft.; breadth, 35 ft.; and depth, 21 ft. 3 in. On leaving the ways the vessel, which has been built to the order of Captain Peter Macfarlane, Port Glasgow, was named the *Don*. She is the third ship built by Messrs. Russell & Co. for the same owner. After the launch the vessel was berthed in the east harbour, where she will receive her masts. When completed she will load at Port Glasgow preparatory to going on a voyage to the East Indies.

Sirenia.—On December 8th Messrs. Charles Connell & Co., Whiteinch, Glasgow, launched the *Sirenia*, a steel sailing ship of 1,600 tons. She measures 264 ft. by 38 ft. by 22 ft. 6 in., and has been built for Glasgow owners for general trade.

Port Sonnachan.—On December 8th Messrs. Russell & Co. launched from their shipbuilding yard at Kingston an iron barque of 1,115 tons nett, and of the following dimensions:—Length, 216 ft.; breadth, 35 ft.; and depth, 21 ft. 3 in. The vessel, which has been built to the order of Messrs. Crawford & Rowat, shipowners, Glasgow, in leaving the ways was named the *Port Sonnachan*. She has been constructed under the superintendence of Mr. William Connall, Glasgow, and will be employed in the East India trade. After the launch she was towed to the harbour, where her masts will be fitted in.

Mirror.—On December 21st Messrs. R. Napier & Sons launched from their shipbuilding yard at Govan a twin screw cable steamer for the Eastern Telegraph Company, London, specially designed by Mr. Joseph Birnie, for laying and repairing the company's submarine cables. The vessel is built of steel to class 100 A at Lloyd's, and is of the following dimensions:—Length, 250 ft.; breadth, 34 ft.; depth, 25 ft. 4 in.; with a gross tonnage of about 1,500 tons. Besides having the usual appliances of a first-class merchant steamer, the vessel is fitted with special tanks for holding cables, and has been sub-divided into 27 water-tight compartments for trimming and ballasting purposes. The cable gear is of the most modern design, and is driven by a pair of powerful engines. It consists of bow guards and triple sheaves, with leads for paying out and taking in cable, dynamometers for registering the pressure, steam, sounding machines, &c. As the vessel is intended for service in hot climates, M'Whirter and Roberts' steam ventilating apparatus has been fitted throughout the ship, which will also be lit by a very complete system of electricity. Two sets of compound surface-condensing engines have been constructed at the builders' Lancefield Works. As the vessel left the ways she was named the *Mirror* by Lady Thomson. It may be mentioned that the *Mirror* is the fourth telegraph cable steamer which Messrs. Napier have launched within a year.

LAUNCH.—Hong Kong.

Agnes.—A new screw steamer, built to the order of Messrs. Victor Roque & Co., of Haiphong, acting for the French Government, by Messrs. Jameson & Croker, of the Novelty Iron Works, was launched at their temporary shipbuilding yard, Belcher's Bay, in October. This is the largest vessel yet turned out by this enterprising firm, and has been specially constructed as a transport for the shallow waters of the Red River. Her principal dimensions are:—Length over all, 130 ft.; beam, 24 ft.; depth moulded 7 ft. The vessel is built of teak wood, with hard wood frames, and is guaranteed to carry 2,300 piculs of cargo with 10 tons of coal on a draught of 5 ft. 3 in. The engines of this new craft will be of the compound inverted cylinder direct acting type, with horizontal condenser. Diameter of H.P. cylinder, 1 ft. 2 in.; diameter of L.P. cylinder, 2 ft. 4 in.; length of stroke, 1 ft. 6 in. Her boiler will be of steel, 8 ft. 10 in. in diameter, and 9 ft. 3 in. in length, constructed to Board of Trade requirements for a working pressure of 90 lbs. per square inch. The furnaces are two in number, 2 ft. 7 in. in diameter. The contract speed is eight and a half knots per hour, but it is confidently expected that she will exceed this without difficulty. A number of friends of the builders were present at Belcher's Bay to witness the launching, which passed off most successfully and without a single hitch, under the direct superintendence of Mr. J. W. Croker. The christening ceremony was performed by Mrs. J. W. Jameson, who broke the usual bottle of champagne over the bows of the *Agnes* as she gracefully glided from the launching ways into the sea. Messrs. Jameson & Croker are to be congratulated on having turned out a vessel which is a credit to the leading industry of the colony.

TRIAL TRIPS.

Enfield.—This screw steamer, which has been built by Messrs. Wm. Gray & Co., West Hartlepool, to the order of Messrs. Pyman & Co., London, proceeded to sea on the 27th of October, having taken on board about 2,800 tons of cargo and bunkers, and previous to starting her first voyage, six runs were made over the measured mile, when a mean speed of 10·6 knots was obtained. Her length over all is 285 ft., and breadth, 37·2 ft. At the trial she was drawing 20 ft. 6 in. of water. She is built with long bridge, 108 ft., reaching to the foremast; the top-gallant forecastle, which is open, is 32 ft. long, and the poop 38·6 ft. long. The crew accommodation is under the fore end of the bridge, and is entered by two strong iron companions on the bridge deck. Emerson & Walker's patent windlass is placed on the forecastle head. Four of Clark, Chapman & Co.'s steam winches, Beck's patent steam steering gear, and all latest improvements are fitted. This is the first steamer fitted with engines by the large new engineering works known as the Central Marine Engineering Company, Limited, Hartlepool. They are on the triple expansion principal, having cylinders of 21 in., 35 in. and 57 in. diameter, and 39 in. stroke, and working at 160 lbs. pressure. Steam is generated in two single-ended steel boilers. During the trial the engines worked in a very satisfactory manner, and there was an abundant supply of steam for working at full power.

Gefion.—On November 26th the twin screw hopper dredger *Gefion*, constructed by William Simons & Co., Renfrew, for the Danish Government, was tried at Port Glasgow. The following gentlemen were present:—Mr. Geitting, chief engineer to the Danish Government; Captain Berg, Danish Government; Mr. Gatow and Mr. Lucas, Bureau Veritas, surveyors; Mr. Anderson, Renfrew, marine surveyor; Mr. Brüin, Copenhagen; and Messrs. Brown, Renfrew. The vessel's dimensions are:—Length over all, 156 ft.; breadth moulded, 30 ft.; depth moulded, 12½ ft. It is divided into eight separate watertight compartments, by which the chances of her sinking are reduced to a minimum. The hopper is situated near the centre of the vessel, and has capacity for 300

tons of its own dredgings, and the time employed in filling same was a little over an hour. The engines are compound surface condensing; one pair is sufficient for dredging, and both pair being made available for propelling or dredging as required. Triple-geared winches are provided at bow and stern for working the mooring chains, having three barrels, each working independently. The latter dredges to a depth of 26 ft., and is controlled by an independent engine on the port side of the vessel. Fitted up on the starboard side there is a workshop, having a drilling and slotting machine to do the necessary repairs on board. As customary in Messrs. Simons' latest dredgers, the bucket ladder is fitted on to a patent traversing carriage, which projects the buckets in advance of the vessel, enabling it to cut in shoals and banks ahead of itself. This is an invention of the builders, and has been found of great value, as vessels with this improvement can be kept at work in tidal harbours, where otherwise they would be idle. After the dredging trials were completed, the vessel steamed to the "measured mile," where a series of runs took place that resulted in a mean speed of seven knots, this being somewhat more than expected. The hull and machinery are built to the inspection of Bureau Veritas, and the vessel is classed in that society. Mr. Geitting superintended the construction of the dredger on behalf of the Danish Government. This vessel is intended to work at the new harbour works at Fredrickshaven, and is the second hopper dredger this firm has constructed for Denmark, and is similar to the hopper dredgers lately constructed by them for the port of Dieppe, France.

Hopper Dredger.—On December 3rd a large hopper dredger, built to the order of the Auckland Harbour Board, New Zealand, had a trial of her dredging capacities in the mid harbour, Port Glasgow. The dredger, which is 172 ft. in length, by 32 ft. by 14 ft., has been constructed by Messrs. Fleming & Ferguson, of Paisley, and is capable of raising 400 tons of ordinary material per hour. The dredger is fitted with a twin screw, and engines of 600 I.H.P., and a hopper capable of holding 600 tons.

Capella.—On December 3rd this steamer made her trial trip. She is built by Messrs. Martens, Olsen & Co., of Laxevag, Bergen, Norway, and is specially intended for the tourist traffic on the North Cape. Her dimensions are as follows:—Length between perpendiculars, 192 ft.; extreme breadth, 28 ft. 6 in.; depth of hold, 14 ft. 8½ in. She is fitted with Martens, Olsen and Co.'s steam winch, Clarke, Chapman & Co.'s windlass, and Davies' steam steering gear. Water-ballast on the cellular system. The engines, of 135 N.H.P., are also made by Messrs. Martens, Olsen & Co. A speed of 12½ knots was easily obtained. The vessel was admired by all on board for her fine construction and elegant equipment. The same firm have on the stocks another passenger boat intended for the conveyance of tourists to the North Cape.

Stella.—On December 5th the s.s. *Stella*, one of the largest well-deckers afloat, built to the order of Messrs. Herskind and Woods, West Hartlepool, by Messrs. Edwardy Withy and Co., of Hartlepool, had a most successful trial trip. The dimensions of the vessel are 312 ft. by 38 ft. by 21 ft., and she had on board 3,650 tons all told, with a freeboard of 2 ft. 11 in. The vessel has a long raised quarter-deck and bridge-house, short poop and topgallant forecastle, and fitted with double bottom for water ballast, all fore and aft, on Withy's improved longitudinal cellular principles; Day's patent enamel cement, five steel watertight bulkheads, and the main, quarter, and bridge decks, bulwarks, rails, and skylights are also of steel. She is fitted with a large donkey boiler by Riley Bros., four steam winches by Rogers & Co., Pepper's patent steering gear amidships, Hastie's right and left screw gear aft, Fothergill's patent reducing valves, Emerson, Walker & Thompson Bros.' patent steam windlass, and Wasteney Smith's stockless anchors, hauling up into hawse pipes. The vessel has been built under Lloyd's special survey for the 100 A 1 class, and owing to her large carrying capacity she has been specially constructed and strengthened to meet all requirements. The *Stella* is fitted with triple-expansion engines 22 in., 37 in., and 60 in. by 39 in. stroke, and two single-ended boilers by Messrs. S. Richardson & Son, Hartlepool, and during the trial trip propelled the vessel at a mean speed of 9½ knots an hour. Captain Petersen had charge of the vessel during the trial trip, and Mr. Fothergill, superintendent engineer, fulfilled the same duties as regards the engineers.

Twin-Screw Hopper Dredger.—On December 7th the trials of the twin-screw hopper dredger No. 4, constructed by Messrs. William Simons & Co., Renfrew, for the Belfast Harbour Commissioners, were completed on the Clyde. This is a duplicate of No. 3, recently supplied to the Commissioners, and will be employed, as is well known, in cutting the deep sea channel in the lough, for which work they have been specially constructed. This hopper has capacity for 800 tons of its own dredgings, and the bucket-ladder dredges to a depth of thirty-five feet below the water level. Steel has been extensively used in connection with the buckets, wheel gearing, &c. The tear and wear, consequently, are greatly reduced. The vessel is propelled with two pairs of compound surface condensing engines of 900 I.H.P., one pair being sufficient for working the dredging machinery. The boilers are of steel, constructed for a working pressure of 90 lbs. per square inch, and the bucket-ladder is controlled by an independent engine, situated in the fore end of the vessel. For manœuvring the vessel powerful winches of special design are placed at the bow and stern, having three barrels which work independently. As usual in Messrs. William Simons & Co.'s latest dredgers, the bucket-ladder is fitted on to a traversing carriage, which enables the buckets to project in advance of the vessel and cut its own flotation through shoals and banks, enabling the vessel to be kept at work when otherwise it would remain idle until the return of the tide. This arrangement is an invention of the builders, and has, we understand, given great satisfaction in similar dredgers. Steam steering gear is fitted up in the wheelhouse amidships, and a look-out bridge is erected on top of main framing. The vessel was built under the superintendence of Lloyd's, Mr. Wiseman acting on behalf of the Belfast Harbour Commissioners. This is the twenty-fourth hopper dredger constructed by this firm, who are the inventors and originators of the present system; and it is stated the working expenses of dredging and depositing the matter ten miles off do not exceed one penny per ton under ordinary circumstances. In order that these dredgers may be kept at work both night and day, the Harbour Board are making arrangements for having them lighted by electricity. Each vessel will be supplied with four lights—one at the bow, another at the stern on masts, and two in the centre at the sides of the dredger. Each light will be nominally of 4,000 candle power, so that the aggregate illuminating power will be nominally 16,000 candles. There will be an engine of from ten to fourteen H.P. for working the dynamos. The steam, too, will be supplied from the boilers of the dredger. The dynamo-machine, lamps, and, indeed, all the appliances connected with the electric lighting, will be of the most approved construction.

Maule.—On December 8th the *Maule* (s), built by Messrs. John Reid & Co., Port Glasgow, and engined by Messrs. Kincaid and Co., Greenock, went down the Firth on her trial trip, and attained an average speed of over 10 knots per hour, which was considered very satisfactory.

Dundee.—On December 8th the steamer *Dundee*, 1,305 tons, built by Messrs. Gourlay Brothers & Co., for the Dundee, Perth, and London Shipping Company, went down the river on a trial trip. Captain Speedy was in command. On getting outside the buoy of Tay, a strong northerly breeze, with a heavy sea, was experienced, so that the speed could not be tested advantageously; but, notwithstanding the adverse circumstances, 14½ knots per hour were attained. The vessel was steered towards Montrose, and rounded the B ll Rock on her return passage, arriving at Dundee in the afternoon. Captain Speedy reports the vessel to be almost perfect so far as her seagoing qualities are concerned. Her engines (triple-expansion), of 320 H.P., worked admirably, and the vibration has been reduced to a minimum.

Knight-Errant.—On December 8th the steel screw steamer *Knight-Errant*, built by Palmers' Shipbuilding and Iron Company (Limited), at Jarrow, to the order of Messrs. Greenshields, Cowie and Co., of Liverpool, was taken to sea for her trial trip off the Tyne. The vessel is a sister ship to the *Knight of St. John*, which was delivered to the owners a few weeks since, and is of the following dimensions:—Length between perpendiculars, 330 ft.; breadth, 43 ft. 3 in.; depth, 29 ft.; deadweight carrying capacity, 4,700 tons. The engines, also built by Palmers' Company, are of the triple expansion type, having cylinders of 27, 44, and 71 in. diameter respectively, and a piston stroke of 48 in. The engines worked smoothly, and the trial was satisfactory to all concerned. The sea was too rough to admit of a thorough trial of the speed of the steamer.

Matabele.—On December 9th this ship was taken for her trial trip at sea. She is 250 ft. long, 35·4 beam, 20·9 deep, built by Messrs. Hall, Russell & Co., to the order of Messrs. J. T. Rennie & Son, of London and Aberdeen. The engines are of the triplex expansion type, with a boiler pressure of 150 lbs., and cylinders of 19 in., 30 in., and 50 in. diameter by 36 in. stroke. On the trial they were handled with the greatest facility, being

reversed in about five seconds. The machinery throughout the trial worked with a perfect smoothness, under a full head of steam, the engines indicating upwards of 800 H.P., and giving the vessel a speed of about 11 knots. Messrs. Flannery and Baggallay, of London, consulting engineers to the owner, have superintended the construction of the machinery, and were on board to assist the Messrs. Rennie, who were present with several well known Aberdeen engineers.

Itamaraty.—On December 11th the *Itamaraty*, a new paddle steamer built and engined by Messrs. James and George Thomson, Clydebank, for passenger traffic in the Bay of Rio de Janeiro, had her speed officially tested at Wemyss Bay. While measuring 200 ft. long by 30 ft. in extreme breadth, her draught, when fully equipped and with all her passengers on board, does not exceed 4½ ft., owing to the limited depth of water available at certain points in the route on which she is intended to ply. The engines are of the jet-condensing diagonal oscillating type. The speed attained was equal to 15·86 knots per hour, which was in excess of the guaranteed speed.

Small Steamer.—On December 11th a trial trip was held on the Mersey of a small steamer built by Messrs. Cochran & Co., of Birkenhead, to the order of Messrs. Macvicar, Marshall & Co., of Liverpool, and intended for local towing service at Java. She is specially designed for service in shallow water, and is 45 ft. long and 9½ ft. beam. There is accommodation forward for a crew of four hands. The hull is of wood, coppered below the water line. She is fitted with high pressure engines, with two cylinders, each 8 in. diameter and 12 in. stroke, and of Cochran's patent vertical multitubular boilers, having 150 square ft. of heating surface, and working at a pressure of 80 lbs. The machinery worked satisfactorily throughout the runs, and the vessel averaged 8 knots per hour. The trial was superintended by Messrs. Flannery & Fawcus, Consulting Engineers, of Liverpool.

Westmoreland.—On December 11th the trial trip of the steamship *Westmoreland* (one of Sir Donald Currie & Co.'s Liverpool and Hamburg steamers) took place from the Mersey, after being fitted by Messrs. Rolls & Sons, of this city, with new direct-acting, surface-condensing, three-crank triple expansion engines, and undergoing other extensive alterations. As this type of engine is being largely adopted to supersede the compound engines, the following particulars may prove of interest to ship-owners and engineers. The *Westmoreland* is a steamer of 1,372 tons gross register, 240 ft. 5 in. long, 31 ft. 9 in. broad, and 16 ft. 9 in. depth of hold. Her new engines have cylinders of 20, 33, and 54 in. diameter respectively, with a stroke of 36 in. and are the first of this type made on the banks of the Mersey, although several compound engines have been converted into triple expansions. Each cylinder is entirely surrounded with steam by a very complete system of jacketing. The steam for the jacket of the high pressure cylinder is led directly from and back to the main boilers, while the steam to the intermediate and low pressure cylinders is reduced in pressure before being admitted to the jackets. The drains from these jackets are let down to neat receivers placed above the condensers (fitted with water and pressure gauges), the receivers in turn drain into the hot well, by which method all the fresh water is saved, the lodgment of water in the jackets is prevented, and the engineer is enabled to adjust the temperature of the steam jackets as required. The high pressure piston is of special design to suit the high working pressure—which is 150 lbs. to the square inch—and the other pistons are fitted with Messrs. Lockwood & Carlisle's patent rings and springs. The piston rods, which are duplicate, and the valve spindles are of steel, while the valve gear has been designed to give extra large bearing surfaces, and is adjustable at every joint. A small starting and reversing engine is fitted on the starting platform, which works a worm and wheel connected to the weigh shaft. This arrangement gives no dead points in the gear, and is useful in heating up the engines before starting. The weigh shaft is fitted with cast-steel slot levers, so that the cut-off can be adjusted in each engine independently, and the steam ports are so arranged that at the earliest cut-off the velocity of the steam is moderate. The bearings for the three cranks are fitted with Stone's navy bronze in strips, and the same kind of metal is used to form the bearing surfaces of the guide shoes. The cooling surface of the condenser is 1,450 square ft., the cold water being supplied by a double-acting pump 11 in. in diameter. The air-pump is 18 in. diameter, single-acting, and fitted with List's patent head bucket and foot valves; and the arrangements of the pumps are such as to allow the utmost room for overhauling. The propellor, which is a four-bladed right-handed screw of 12 ft. 6 in. diameter, with a true pitch of 18 ft., is cast of the maker's special propeller mixture. The steam is supplied by two single-ended boilers, 12 ft. diameter by 9 ft. long, each having three of Foxe's corrugated furnaces, the grate surface being 68 square ft., and the heating surface 2,400 square ft. The boilers are constructed of mild steel, to the requirements of the Board of Trade and Lloyd's surveyors for a working pressure of 150 lbs. per square inch. For the purpose of supplying water to the main boilers, at the rate of 20 gallons per minute, and also to the condenser, the "pressure" pumps manufactured by the Worthington Pumping Company, of Queen Victoria-street, London, are employed, and are stated to give great satisfaction. A select party left the Prince's Landing-stage for the trial trip, including Mr. Graham (the company's manager), Mr. List (the company's London engineer), Mr. W. Glover (the company's Liverpool engineer), under whose superintendence the work was carried out, Mr. David Rollo, Mr. George Rollo, and several other superintending and consulting engineers. The vessel was carefully timed on the measured mile, and attained a speed of 11½ knots per hour, with 720 I.H.P., the engines running 70 revolutions per minute with the utmost smoothness, and the consumption of fuel being 1½ lbs. of Lancashire coal per I.H.P.—a saving of about 25 per cent. A four hours' cruise followed, and the vessels compasses were adjusted by Sir William Thomson's Liverpool representative. Much satisfaction was expressed by all on board at the result of the trial, and the contractors were complimented on the success of their work, and the excellent manner in which the whole of the alterations had been carried out. A very enjoyable day was spent, the weather being exceedingly favourable. After dinner in the saloon, Mr. John Horn presided, and the usual loyal and other toasts were duly honoured. Mr. David Rollo, in proposing success to the vessel, remarked that this was the first of Sir Donald Currie & Co.'s fleet which had been converted to triple expansion, and if the results attained that day were maintained on the expected economy of fuel, no doubt the company would feel justified in adopting this improved type of engines for other of their steamers. There could be little doubt that the triple expansion engines would entirely take the place of the compound type. Mr. Glover and Mr. List replied, the latter remarking that the machinery quite came up to the expectations of the company, and nothing could be more satisfactory than the way in which it worked. It may be added that Messrs. Rollo have in hand several other sets of this new improved type of engine.

Torpedo Boat.—On December 14th a large torpedo boat of a distinctly new type, having rotating conning towers, to each of which is attached a couple of Whiteheads, and built by Thornycroft & Co., was tried for speed at Portsmouth. It is 125 ft. long, the largest torpedo craft of the kind received, and is one of the 50 first-class torpedo-boats ordered by the government from Messrs. Thornycroft, Messrs. Yarrow, and Mr. White, of East Cowes. Some slight defect in the steering gear, which caused the double rudder to jam, arrested the trial for endurance, but the runs on the measured mile were completed, the mean of six giving the extraordinary speed of 20·9 knots per hour. As soon as the defect has been remedied, the boat will be driven continuously for six hours for the purpose of ascertaining the amount of fuel consumed per hour with the engines working at full power.

Bengal.—On December 15th the steamer *Bengal*, the latest addition to the fleet of the Peninsular and Oriental Company, went down the Firth of Clyde on her official trip. The *Bengal*, which has been built by Messrs. Caird & Co., Greenock, is a duplicate of the steamer *Coromandel*, launched by the same firm for the Peninsular and Oriental Company in the month of June last, and, like the *Coromandel*, has been fitted with inverted direct-acting compound triple expansion engines, and three double-ended boilers, having a working pressure of 140 lbs. steam and 3,200 I.H.P. The cylinders are respectively 36, 56, and 89 in. with a 5 ft. 6 in. stroke. Her high pressure cylinder is fitted with Church's patent rectangular balanced slide valve. The sister ship, the *Coromandel*, is likewise fitted with the same arrangement of balancing; she has made her first voyage to Calcutta and back, and on examination was found to be in perfect condition. The number of furnaces is 25, the condensing surface is 7,000 square feet, and the fire-grate surface 328 square feet. Her principal dimensions are:—Length, 400 ft.; breadth, 45 ft.; depth of hold, 31·9 ft.; displacement of 25 ft., 8,800; and deadweight capacity, 4,200 tons. The *Bengal* has accommodation for 111 first-class and 44 second-class passengers. There are 195,000 cubic feet of clear

cargo space, exclusive of the mail and baggage rooms, and she is supplied with all the most modern appliances for facilitating the loading and discharging of cargo. Like the *Coromandel* the *Bengal* has been so constructed that she can easily be converted into a transport, her lower decks being specially fitted up for troops. The *Bengal* has been built entirely of mild steel, all of which was carefully tested. She is divided into eight water-tight compartments, and all the water-tight doors are worked from the main deck, which is a good height above the water-line. The steamer has been built with a straight stem, elliptic stern, and three decks, with full poop and topgallant forecastle, houses on poop for companion, captain's cabin, smoking room, &c., and she is rigged as a three-masted schooner. The poop, main, and lower decks are of steel from stem to stern, sheathed with teak three inches thick, while the top deck has the usual stringers and longitudinal ties sheathed with yellow pine. The beams of all the decks are of great strength, being on the buttery system. The vessel is fitted with Hastie's patent safety rudder brake. The construction of the *Bengal* and of her engines was carried through under the supervision of Mr. W. J. Taylor and Mr. Pettigrew, the company's superintendents, and under special survey at Lloyd's. At the trial trip the measured mile was run several times. The engines worked smoothly, and the average speed attained on the several runs was at the rate of 15 knots an hour. As the guaranteed speed was 14 knots, the result of the trial was considered eminently satisfactory.

Holland.—On December 16th the steam fishing cutter *Holland*, built and engined by Messrs. Earles Shipbuilding and Engine Company, Limited, Hull, for the Boston Deep Sea Steam Fishing and Ice Company, Limited, was taken on her trial trip. The following are the particulars of the vessel:—Length, p.p. 100 ft.; breadth, extreme 20 ft., and depth of hold to top of floors 10 ft. 6 in. She has a raised quarter deck aft, bridge amidships, and forecastle. Iron casings over engine and boilers, with galley at fore end; is dandy rigged with two pole masts, and has accommodation for captain, mates, and engineers in cabin aft, and for crew in forecastle. The vessel is fitted with patent windlass, worked by messenger chain from a 6 in. by 10 in. steam winch of Earle's special make and design. She is propelled by a set of compound engines on the triple expansion system, also made and fitted by Messrs. Earles, and having cylinders 11½ in., 17 in., and 30 in. diameter by 21 in. stroke, and supplied with steam from a steel boiler made for a working pressure of 150 lbs. to the square inch. During the run the weather was very rough and the sea going capabilities of the vessel were thoroughly tested with very good results, the speed attained being about 10½ knots, and the engines worked most smoothly and satisfactorily.

Caloric.—On December 21st the *Caloric* (s), just completed by Messrs. Harland & Wolff, Belfast, proceeded on her trial trip, prior to taking her place as the latest addition to the Belfast Steamship Company's fleet on the station between Belfast and Liverpool. This vessel is fitted up very much on the lines of the White Star steamers, a distinguishing feature being that the saloon and the sleeping cabins are kept entirely distinct. The ship is fitted throughout from stem to stern with the electric light, not only in the passenger accommodation, but also in the engine-room and crew's quarters. There are also special electric lights for use during the loading and discharge of cargo. The *Caloric* is built of steel, is 243 ft. long by 31 ft. 6 in. breadth of beam, is classed A 1* in red, and is driven by a pair of compound surface-condensing engines (also constructed by Messrs. Harland and Wolff), developing 1,500 H.P., and calculated to give her a speed of 15 knots an hour. Her boilers and crank shaft are also of steel. The anchors and cables are worked by a steam windlass; she has steam winches and a deck crane for working cargo; she is steered by steam from the captain's bridge, and is otherwise fitted with all the most recent improvements.

Paddle Steamer.—A paddle steamer, 45 ft. by 9 ft. 6 in., built of steel, by Messrs. Beesley & Sons, Barrow-in-Furness, has been tried recently. The machinery was supplied by Messrs. Jensen & Co., of Birkenhead, and is Jensen's system applied to paddle engines. The engines worked with their usual ease, and drove the paddles (Beesley's patent) at the rate of 110 revolutions per minute.

Gun Boat.—A trial was lately made on the Mersey of a small steam vessel built by William Dickinson, of Birkenhead, to the order of the Crown Agents for the Colonies, and intended for government patrol service on the Gold Coast. A considerable amount of petty piracy takes place on the rivers of that colony, and with a view of suppressing this, the vessel referred to has been designed by Sir E. J. Reed, M.P. She is 40 ft. long, and of proportionately very wide beam, and extremely shallow draught, and is armed with one 7-pounder gun forward and also three lighter swivel guns. There is accommodation for one officer and a crew of six hands. Hull is of wood, coppered below water line, and the engines are of the twin screw type, with a large boiler capable of burning wood. The vessel was taken to Eastham, and her speed noticed, the mean result being about 10 knots per hour. The trial was superintended by Mr. John Hudson, Naval Architect of Sir E. J. Reed's staff.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from November 20th to December 10, 1885.

14192 W. M. Bullivant. Torpedo nets.
14196 G. Poore, C. Ingrey. Motors.
14202 J. F. Russell. Direct application of steam to circular motion.
14204 E. Latham. Marine steam engines.
14208 J. J. Harwood. A marine masked signal lamp.
14215 E. Buss and E. Müller. Pumps.
14220 J. J. Royle. Producing motive power.
14226 E. Friedrich and M. Jaffé. Expansion gear for steam and other motors.
14248 W. Robson. Hydraulic engine.
24295 P. Hoppe. Securing tubes in the tube plates of steam boilers.
14312 A. C. Koerner. Naval carriage for rapid firing and other guns.
14331 L. Hopcraft. Rocking furnace bars.
14341 J. H. Fraser. Steam boilers.
14342 J. C. Peacbe. Central valve engines.
14375 G. Dixon. Metallic rings for pistons.
14386 C. Melin. Gauge glasses.
14392 T. S. Dobson and A. Murfet. Steam boiler and other furnaces.
14396 J. A. Berly. Screw propellers.
14399 E. H. Pye and J. H. Turvey. Compound steam engine cylinders.
14400 J. F. Haskins. Governors.
14416 Clark (M. L. J. R. Labbe de Montais). Steam boilers.
14417 R. Murray and J. Paterson. Steam boilers or generators.
14423 D. D. Hardy. Steam engines.
14442 T. Melling and F. Butterfield. Water and other motors.
14460 J. T. Milton. Steam boilers.
14482 R. H. Armit. Machine or battery guns.
14491 L. Levi. Soundings indicator.
14542 A. M. Wood. Life-boats.
14555 J. W. Whitley and J. Keith. Valves.
14561 W. Jones. Machine guns.
14574 J. Black. Motive power engines.
14585 M. Straker. Vertical steam boilers.
14587 C. T. Crowden and H. J. Pausey. Cranks.
14589 W. Balch. Disengaging ships' boats.
14590 J. Bremner. Steam engines.
14591 Edwards (Mons. Carrette). Lubricating bearings.
14633 Clark (E. F. & F. B. A. Royer de la Bastie). Submarine electric cables.
14654 S. Eddington and J. E. Steevenson. Water gauges for steam boilers.
14657 J. A. Rowe. Furnaces of steam boilers.
14676 A. J. Sedley and E. Cole. Single or twin boats.
14680 W. H. Martin. Auxiliary starting gear for steam engines.
14690 Edwards (J. B. Beun). Throttle valves.
14698 W. Lorenz. Bearings for shafting.
14700 J. & H. J. Anthon. Bearings for shafts and axles.
14708 J. Templer. Surface condensers.
14715 H. Robins and E. Robins. Immediately altering the course of vessels, &c.
14723 J. Harrison, W. Loynd, R. H. Clayton, and J. S. Loynd. Slide valves of steam engines.
14724 W. Fawcett and A. Thomlinson. Pumps.
14733 L. Berry. Steam boilers.

14753 J. Richardson. Governor for steam engines.
14757 Newton (J. & G. H. Bliss). Fans for ships' logs.
14758 Reed (J. Ham). Boiler furnaces.
14761 P. F. Wohlgemuth. Saving life at sea.
14762 A. Stigler. Bearings for shafts.
14777 T. Nordenfelt. Engine for pumping air, &c.
14783 A. Stevenson. Continuous and automatic lubrication of journals and bearings.
14784 W. C. Ingham. Reversing the rotary motion of a shaft.
14787 F. Lee. Protection of ships of war, &c.
14788 W. W. L. & J. T. Lishman and W. R. Bookland. Sternposts of vessels.
14800 F. H. Moldenhauer. Feeding boilers.
14814 J. Gilchrist and D. Ballardie. Ships' lamps.
14818 L. Petry and W. Walther. Tubular steam generators.
14832 L. Hopcraft. Rocking furnace bars.
14837 O. White. Ships' telegraphs.
14839 W. Schmidt. Jacketing steam cylinders.
14873 T. & M. Morris. Lubricating cocks.
14879 J. Matthews. Self-lubricating bearings.
14882 J. Weir. Feed pumps.
14883 J. K. Broadbent. Boiler furnaces.
14890 F. T. Adams. Rotary pumps.
14891 W. Skinner and others. Ships' telegraphs.
14895 G. Gaunt. Welding boiler and other tubes.
14913 E. Friedrich and M. Jaffé. Steam boilers.
14937 J. & J. Rigby. Yielding shaft couplings.
14952 J. Simmons and J. Woodgate. Furnace bar.
14959 J. Donald. Steering apparatus for steamships.
14996 J. Taylor. Steam pumps.
14999 C. A. Knight. Steam boilers.
15008 G. Fletcher and W. P. Abell. Valve gear.
15019 C. C. L. Luchs. Propelling and steering ships.
15024 J. H. Bolles and J. N. S. Williams. Dredgers.
15029 J. Haythorn. Metallic packing.
15047 S. Butler. Compound engines.
15048 W. F. Martin and others. Condensing engines.
15049 J. Wright. Anchors.
15059 W. H. Martin. Valve gear.
15075 H. B. Baker and G. B. Blazer. Steam boiler cleaners.
15076 H. R. Luder. Compasses.
15085 J. Barreefes y Veciana. Wave power or tidal motors.
15093 S. H. Stubbs. Furnaces for steam boilers.
15110 C. A. Coombe. Utilising the power in steamships, &c.
15126 Gedge (J. B. Granjon). Steam trap.
15150 C. W. Hill. Motive power engines.
15155 Ferguson (J. Mailer). Steam boiler and other furnaces.
15156 T. Smith. Steam boilers.
15165 T. Smith. Torpedo.
15167 G. D. Davis. Controlling rudders of ships.
15174 A. J. Sedley. Steam engines.
15179 H. Barrett. Propeller shafts.
15194 N. P. Burgh and A. Gray. Producing motive power.
15198 M. H. Taylor and L. Benjamin. Life boats.
15217 S. Perkins. Fixing metal tubes into plates for boilers.
15224 G. J. Hambruch. Lubricating pump.
15229 C. Hoare. Propelling boats, &c.
15231 J. Blenkinsop. Protecting iron and steel ships' plates.
15242 T. R. Spence. Steam and other engines.
15250 Lake (L. Poillon). Rotary pumps.
15256 G. A. Calvert. Mud-box for bilge pumps.
15262 E. Morley. Boilers.
15263 H. F. Wilcox. Supplying sea water to towns.
15264 W. Wright. Slide valves of steam engines.
15266 G. Beall. Compass deviation model.
15280 J. J. Royle. Return steam traps.
15297 A. Lencauchez. Supplying and heating feed-water to steam boilers.
15300 N. Roser. Steam boilers.
15304 D. J. Morgan and J. H. Plews. Fire bars and holders.
15335 J. Klein. Pump.
15351 A. Yacoubenso. Steam boilers.
15368 R. Bentley and T. Ford. Valve.
15379 F. M. Wheeler. Surface condensers.
15395 R. S. McLaren. Steam pumps.
15398 C. N. Nixon. Propelling ships, &c.
15400 Boult (C. W. Field, jun.). Screw propellers.
15410 A. F. A. Vogelsang. Propellers.
15414 Edwards (A. Behnisch). Lubricators.
15418 W. H. Hatfield. Capstans.
15423 W. J. Brewer. Gun battery and conning tower.
15430 C. G. Clarke. Ships' brake.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

November 21st, 1885.

Herbert, A. J... 2C London
Knapp, Wm. L. 2C Liverpool
Leith, A. ...... 2C London
Newall, James.. 1C Liverpool
Puckfield, L. R. 2C ,,
Weathcuilt, G. E. 2C London

November 28th, 1885.

Aird, Hugh .... 2C Belfast
Beazley, Ernest 2C London
Brodie, Robert.. 1C Sundrlnd
Bulley, John .... 2C Liverpool
Chalcraft, A. E. 2C Sundrlnd
Cowell, E. H. .. 1C ,,
Cranch, John .. 2C London
Currie, Matthew 1C Sundrlnd
Dalrymple, A. U. 1C Dundee
Dixon, H. W. .. 2C London
Doughty, S. .... 2C N Shields
Ellerington, Wm. 2C Sundrlnd
Gedsetzer, J. P. H. 1C N Shields
Gilchrist, John.. 2C Glasgow
Kennedy, Edwd. 2C Hull
Lamotte, Richd. 1C Sundrlnd
Laing, R....... 2C Aberdeen
Lorimer, Andrew 1C Belfast
MacLennan, J. 1C N Shields
Moor, Wm. .... 2C ,,
Murray, John .. 2C Liverpool
Piggford, J..... 1C Sundrlnd
Richardson, J. B. 2C ,,
Robson, H. S... 1C ,,
Sarginson, W. R. 2C Belfast
Thompson, Thos. 2C N Shields
Twentyman, R. G. 2C ,,
Waldie, James.. 2C Aberdeen

December 5th, 1885.

Aitkin, M. .... 1C Glasgow
Barber, Wm. .. 1C N Shields
Barrett, James 1C Greenock
Beynon, J. R. .. 1C Bristol
Boodt, Hans P.. 2C Glasgow
Brown, Andrew 1C ,,
Gow, D. ...... 1C Liverpool
Holliday, Thos. 1C ,,
Holliday, Wm... 2C ,,
Kerr, C......... 2C ,,
Kitto, C. J. .... 2C ,,
Macaulay, Rbt. 2C ,,
Morgan, Thos. G. E1C Dundee
Perrett, H. .... 1C Bristol
Peters, John S.. 1C ,,
Pettigrew, Wm. 1C Glasgow
Rattray, Peter.. 1C Dundee
Rose, David.... 1C Glasgow
Taylor, W. C. .. 1C Greenock
Walker, Alex... 2C ,,
Wilson, John H. 2C N Shields
White, Thos. H. 1C ,,
Young, Arch. .. 2C Glasgow
Young, C. J.... 1C N Shields

December 12th, 1885.

Ake, J. W. .... 2C Hull
Albsbury, James 2C Leith
Appleby, Harry 2C W H'pool
Ashworth, J. L. 2C Liverpool
Blundell, W. H. 2C London
Brooks, T. M. .. 1C ,,
Brown, David C. 2C Hull
Butchart, Wm.. E1C Aberd'n
Christie, Wm. .. 2C Leith
Clark, Jas. A. .. 1C ,,
Clayton, Wm. .. 2C Liverpool
Drake, Wm. E.. 2C Plymouth
Dempster, Robt. 2C Glasgow
Dennis, R.H. .. 2C Liverpool
Donaldson, Thos. 1C Leith
Elmslie, E. C. S. 2C London
Ferguson, Jas... 1C Leith
Ferguson, John 1C Glasgow
Gifford, Robert.. 1C Leith
Hirst, Abrm. F. 1C Hull
Johnston, H. L. 2C Glasgow
Jordan, Jas..... 2C ,,
Lindsay, Frnk. C. 1C London
McGregor, Jas. E1C Glasgow
McLay, David.. 2C Leith
Paxton, Thos. ... 1C ,,
Pringle, Alex. .. 1C N Shields
Pritchard, A. T. E1C Cardiff
Ramage, Alex... 2C Leith
Robertson, J. C. 1C Dublin
Rushton, Herbt. 2C W H'pool
Shaw, Alex. W. 2C Hull
Slater, Fred. T. 1C London
Urquhart, Wm. 1C Leith
Waldron, Jas... 1C Dublin
Welch, William 2C ,,
Wilson, Richard 1C Glasgow
Wood, Walter J. 1C Hull

December 19th, 1885.

Adamson, Jas... 2C Sundrlnd
Boomer, Henry 2C Dublin
Brown, Alex. W. 1C Sundrlnd
Cain, Thos. H... 2C Liverpool
Chapman, C. D. 2C Dundee
Clarke, F. R. .. 2C London
Coke, Thos. .... 2C Liverpool
Darby, James .. 2C ,,
Dial, Richard .. 2C Sundrlnd
Donald, J. Milne 1C London
Easthope, James 2C Cardiff
Fairweather, F.. 1C Dundee
Fleming, Robt. 2C Liverpool
Gregory, C. J... 2C London
Green, Albert .. 2C ,,
Harrison, Thos. 2C Sundrlnd
Heard, Geo. H. 2C Cardiff
Hedley, J. I. .. 2C N Shields
Henderson, G. D. 2C ,,
Hodge, Alex. D. 1C Glasgow
Howe, John G. 2C Sundrlnd
Hume, W. Gott 1C ,,
Jackson, D..... 2C Liverpool
Johns, W. H. .. 2C Cardiff
Johnston, Andw. 2C Glasgow
Lennard, George 2C Cardiff
Lynch, A. .... 2C N Shields
Milne, David .. 2C ,,
Mitchell, Alex.. 1C London
Pott, Charles .. 2C N Shields
Powell, Walter.. 2C London
Rice, Matthew.. 2C Dublin
Robertson, D. .. 2C Dundee
Rogers, Thomas 2C Cardiff
Smith, Jas. G... 2C N Shields
Taylor, Robert.. 2C Dundee
Turnbull, J. M. 2C Glasgow
Wall, David.... 1C Cardiff
Williams, Evan 1C Cardiff
Wilson, A. L. .. 2C Dundee
Yates, H. H. .. 1C Liverpool

The Marine Engineer.

LONDON, FEBRUARY 1, 1886.

EDITORIAL NOTES.

ONE of the most delicate and important fittings in a modern vessel is the compass, and it is at present probably the least capable of control and less reliable than any other mechanical device upon which the mariner depends for the successful completion of his voyage and his safety. The magnetic north is a most irregular and troublesome datum on which to depend for regulating the course of a vessel, since it is constantly upon the move, having its periodical variation east or west of the true astronomical north. Of course this variation is known and tabulated for the use of mariners, but there are an infinity of small irregular variations of which no record can be kept, and which can at no time be foreseen. Apart from the aforesaid irregularity of the magnetic north, the instrument in common use as a mariners' compass is itself subject to a large variety of disturbances. This tendency to disturbance is now very greatly increased by the general use of iron and steel for the building of the hulls of vessels, not only of the navy, but of the mercantile marine. Such hulls have themselves, particularly those made in steel, the power to become more or less permanently magnetised, and thus to present enormous deflecting influence upon the compass needle. The correction of these disturbing effects, together with the errors known as quadrantal, semicircular and heeling, are sought to be obviated by a variety of ingenious contrivances, such as the insertion of fixed magnets within or about the compass-box, and further by the use of unmagnetic iron globes. Sir William Thompson has made his name famous for the multiplicity of ingenious devices that he has from time to time contrived for this purpose, and we see that he is again putting out further improvements dealing with these errors in a practical shape, for the benefit of mariners. But after all this has been done, and with every credit to the extreme ingenuity shown by Sir William Thompson and other scientists in effecting corrections of known errors, there still remains so large a margin of possible errors, which may arise from time to time, owing to the alteration of the magnetic conditions under which the compass was first set, that we cannot but feel that we are still far from having an instrument of such reliability as might be desired for the purpose of always indicating his true course to the mariner. Probably in the course of another generation, so rapid are the present strides of improvement and invention, our descendants will be surprised at the complacency with which we have put up so long with an instrument so generally known to be irregular and unreliable in its action as the magnetic compass. It is of course difficult to imagine or foresee in what way such an instrument may be superseded or replaced, but we may give our ingenious readers the benefit of such ideas as may strike us upon the subject. We have heard not long ago, of a compass still magnetic in its action, which claimed by the combination of two independent needles to indicate a duplicate error of deflection, whatever that error might be, one needle deflecting in one direction and the other deflecting in the opposite direction on either side of the true magnetic north. It is evident then that should the action of this device be accurate in the above respect for all cases of disturbance, the mean reading of the two needles would always give the true magnetic north at any rate. Whether such a compass will be found in practice always to fulfil these conditions, we have no means for knowing, but we have not yet heard of such an appliance being ever successfully used at sea. We have again heard, that the light itself was affected by the lines of magnetic force running north and south; so that, could means be devised for clearly indicating this effect upon the light of day, by rendering it visible to the mariner, he would require no further indication as to the true magnetic north. Such an indication, were it possible to practically achieve it, would, at any rate, be uninfluenced by any local magnetic disturbances which would eliminate a great number of small irregularities. As a suggestion, we might point out that the true astronomical north is the centre of the rotation of this globe, which takes place round its own axis, and we think it within the bounds of practicability that an instrument might be devised, while partaking of the rotary movement of the earth, to always indicate the direction of the axis of rotation. If this were possible, we might dispense with the magnetic needle altogether, and in that way avoid the whole of the irregularities arising both from local disturbances and from the irregular and known movements of the magnetic pole.

WE are indebted to a contemporary for further suggestions upon that most important problem to shipbuilders, the behaviour of mild steel, after it has been worked and riveted. We offered several suggestions in our last issue, as to possible causes leading to the astounding fractures and failures of steel plates after they have successfully

stood the most severe tests of manufacture. Our contemporary now adds a complete theory of the action of such plates, using the important analogy of the action of glass. In the case of glass, it is well known that it is a material of perfect homogeneity, possessing great elasticity and considerable strength, and yet it may be noticed by anyone in the ordinary glass vessels in common use, or as is a well known danger to plate-glass windows, that if a crack once developes from any cause, the crack has a tendency to extend throughout the whole of the body, even from the ordinary variations of temperature of day and night, or under the vibration of street traffic, or even sometimes without any further perceptible exciting cause at all. Now this action is very similiar to that which has been observed to take place in steel plates, and in one important item these two materials are exceedingly similar, that is they are both homogeneous and crystalline. The theory of the extension of such cracks is, that once a sufficient stress has been developed to commence the disintegration of the material, that stress, if continued, will evidently suffice to continue the disintegration, as it merely acts in succession of a series of particles similarly situated to one another, and with similar cohesion. It is more difficult to attempt to explain how such a crack tends to continue its development by mere jar or vibration, or without any sensible vibration at all, unless there is originally great tensional stress in the material. In all boiler plates the first named theory will suffice to explain the ultimate disruption of the plates, after once a small crack has commenced, as such plates are always subjected to a constant tensile stress, which, if sufficient to start a crack, will in a homogeneous material be sufficient gradually to continue the same to complete disruption. The flying in pieces of angles, or ship's plates, after they have been successfully worked and placed in position, is more difficult to explain on the above theory, but to our minds there is no doubt that in such case great internal stress is developed in the material by the bending or working to which such angles and plates are invariably subjected. The starting of the cracks is no doubt due to punching the rivet holes, or to the unavoidable opening of the metal on the convex side of sharp bends, which may not be regarded as of any great consequence, since they would not be of any great detriment to wrought iron. The theory of such failures is only of subsidiary importance to our readers, compared with a knowledge on their part as to what is best to do to avoid the consequent failures which are threatened. We have one strong feeling in the matter, and that is the necessity of annealing after each and every class of working or punching the material. Next, any process which tends to develop cracks, or to put abnormal stress even on small portions of the metal, should be avoided if possible; such, for instance, as punching rivet holes. Drilling should evidently be preferably used under the circumstances, but if punching should be preferred, either the hole should be rimered smooth, or the plates should be at once annealed. All working cold should be avoided, unless the material is immediately afterwards annealed, otherwise the internal stress developed by cold working is just the thing to set up incipient cracks, which will then immediately tend to develop, and produce ultimate fracture.

In consequence of considerable ventilation of the unexpected defects in steel plates, much attention has been drawn to the subject generally, and a great deal of interest attaches on the part of the steel manufacturers and steel users as to whether the reported defects can be identified as peculiar to either the Bessemer, Siemens, or basic processes. From the information that we can gather, we do not think that the general defects of steel plates and frames (of which there are so many instances known) can be attributed in particular to either of the above processes, as there is no doubt that many sound and trustworthy plates, angles, and frames, &c., are produced from each of the above processes. We must, therefore, consider that the startling fractures in mild steel are to be attributed rather to the homogeneous and crystalline character of the metal itself, however produced, to the probable impurity by excess of phosphorus or sulphur in plates or other parts which have proved most strikingly deficient in quality, or to the peculiarities following the special methods of working adopted in the putting together of the material, rather than to the distinct process by which the steel itself was produced. Under these circumstances, we think the late peremptory orders by Lloyds' inspectors, not to accept any more steel made by the basic process for ship's hulls, is too precipitate, and probably ill advised. We have no doubt this order arises from the action of the well-known firm of Bolckow, Vaughan & Co., who have declared that they will make no more plates by the basic process. It is impossible, without precise information, to know the exact grounds upon which the latter firm have thus decided to suspend all manufacture under the basic process, but we must confess it looks to us rather like a mere scare on their part, and that the basic process has been made the scapegoat for probable neglect of some proper attention in the manufacture or working of the plates, or perhaps for

some special impurity in the particular plates in question. As the unexplained breakdowns and fractures have been spread pretty uniformly over all the processes, if each firm from whom the faulty material has been obtained were to declare against the process by which it had been produced, mild steel would probably cease to exist as applicable to the hulls and frames of ships, or for boiler plates. There seems to be a strong feeling existing in the minds of those who are somewhat behind the scenes, that in some of the startling cases about which so much has been said, the material was known to be more or less questionable in its character, and that its deficiencies might have been ascertained by a sufficiently rigid test. In order to settle this question, and restore peace once more to the steel market, it behoves every person who may have information to give upon this subject to afford the same as publicly as possible to the technical journals, so that, if possible, the character and deficiencies of mild steel may have a thorough sifting, and that no undue or absurd scare against mild steel in general may arise.

ONE of the most important departures in marine boiler construction of late is the application of forced draught to the furnaces. The advantages to be obtained from this system, if it proves economical and durable, are obvious. Less boiler room will suffice to generate the necessary steam. Fewer furnaces will be necessary, and, with the mechanical form of stoking, a large number of hands may be dispensed with from the stokehole. These in themselves are results of such commercial advantage to shipowners of the commercial marine, that there is no doubt such a system would be readily taken up by them were they assured of the success and ability of the general arrangements. Mr. Howden has lately brought himself into conspicuous notice by the very successful adaptation of his forced draught system in the *City of New York*, but further particulars are wanted for the trade at large with regard to the main question: Does it pay in the long run? We should be very glad, for the benefit of our readers, if Mr. Howden or anyone else would provide the necessary information, and give us some details on this point for publication. The chief points upon which information seems to be wanted are—1st. What is the decreased amount of boiler room required to develop the necessary horse power, as compared with the old system of natural draught? 2nd. At what economy of fuel per indicated horse power is the forced evaporation effected as compared with natural draught? 3rd. Is the continuance of a forced draught, and consequently high temperature in the fire-box, under Mr. Howden's or any other system of forced draught, found to be ultimately seriously destructive to the flues or tubes of the boiler? 4th. What difficulties are experienced in the matter of fire grates, as with the high temperatures required for forced draught we believe the ordinary cast iron bars are very apt to melt and drop?

It is obvious that the Admiralty necessities in a forced draught are by no means the same as those required for a successful application to the commercial marine. In the former case, economy is of no very great consequence, and it is only intended in most cases of application that the forced draught should be used for a temporary purpose, and for a limited time. For successful application, however, to the commercial marine it is necessary that the arrangements shall pay commercially, and that it shall be proved to be a commercial success when used continuously at sea, as in the case of the application of Mr. Howden's system to the *New York City*. We believe that Mr. Howden is now collecting all the necessary information on these points, from the lengthy experience he has now had in the constant use of his apparatus at sea, and we shall be extremely glad to hear his results financially, when they are ready for publication.

LIQUID FUEL FOR STEAMERS.

ANOTHER application of liquid fuel to steamers has been made on a new ship recently launched by Messrs. Wigham, Richardson & Co., of Newcastle-on-Tyne. The steamer, which is intended for the Black Sea trade and to be permanently oil-burning, has her water-ballast tanks divided up and made available for the storage of her fuel; she has also other storage-tanks built into the ship on each side of the engine-room, all these being connected by pipes to the small feed-tanks situated above the boiler.

A large supply-pipe, connected through valves to the storage-tanks, allows of her being filled up with fuel in a very short space of time.

The oil-burning apparatus has been fitted by Tarbutt's Liquid Fuel Company, Limited, of 75, Lombard Street, London, and is similar to that adopted on board the steamer *Himalaya*, which recently made her successful trial trip from London to Granton and back with the new fuel. It consists of an automatic starting arrangement which provides the supply of oil to the furnaces during the period of getting up steam without the aid of an auxiliary boiler, and an arrangement for highly superheating the steam which is used for forcing in the oil, and by its means of raising the temperature of the fuel to burning point as it enters the furnace.

A trial of the apparatus has just been completed at Messrs. Wigham, Richardson & Co.'s works, and was witnessed by representatives of some of the leading shipbuilding and engineering firms on the Tyne, who are evincing great interest in this most recent development of the fuel question. The first trials made showed that the evaporative effect of the oil used, which was a residue of Scotch shale oil, was 15½ lbs. of water to each pound of oil as against 8 to 9 lbs. for 1 lb. of coal. Subsequently the engines, which are only just completed, were started for the first time and kept running for some hours at from 84 to 96 revolutions per minute.

The trials were altogether a great success, and it is understood that a number of other applications of this system of burning liquid fuel are now being made both to marine and stationary boilers as well as to stills and plate-heating furnaces.

LATEST TORPEDO-BOAT BUILT IN GERMANY.

A first-class Torpedo-boat called the *Orion*, and built for the Spanish Government by the Germania Werft, Kiel, left that place on the 30th of December, for Ferrol. The boat was launched on the 24th of November, and had the first trial of the engines at the quay of the builder's yard, on the 4th of December. The official trials took place on the 13th, 19th, and 21st of December, in presence of a Spanish Commission and the officers of the vessel, besides a German Naval Officer and Engineer Officers, who were, by request of the Spanish Government, deputed by the German Admiralty to witness the trial trips. The full equipment and 10 tons of coal were on board, and the following results were obtained. The consumption of coal was measured on the first trial, and it was ascertained that the boat can carry sufficient coals in her bunkers to steam 2,100 knots, at 10 knots speed.

The second trial took place under the same conditions, and consisted of a continuous run of five hours, with a mean speed of 19·86 knots, a highly satisfactory result, as only 19 knots for three hours were guaranteed.

The third trial was merely a speed trial, four runs on the measured mile being made, and giving, with a little over 1,000 I.H.P., a speed of 21·53 knots against 21 guaranteed.

The Spanish Commission, consisting of the Naval attachés at Paris and Berlin, and an engineer officer of the Spanish Admiralty, were exceedingly pleased with the result, and received the vessel immediately after the last trial trip. Since that date arrangements have been made on board for the voyage and the installation of the Spanish crew, consisting of 2 officers, 3 engineers, 1 boatswain, and 11 men, besides an engineer who is accompanying the boat on behalf of the builders, and she will take her route through the Eider Canal and probably call at some English and French ports in the Channel.

The boat is built entirely of German steel, and has the following dimensions:—Length, extreme, 38 metres; breadth, extreme, 4·8 metres; depth, amidships to the keel, 2·6 metres. The mean draft at the trial trips was 1·1 metre, thus giving a considerable and safe freeboard, the displacement being 88 tons. She has two torpedo tubes forward under a turtle back, and is fitted with Schwartzkopff's torpedos and gear combined, with their hydraulic lifting arrangement. There is a conning tower forward from which the torpedos are fired and from where the vessel is steered by steam gear as well as by hand. Another conning tower with hand-steering gear is placed aft, and serves at the same time as charthouse and entrance to the officer's cabins.

There is a speaking tube connection between the two conning towers and from them to the engine room, besides engine-room telegraph, which can be worked both inside and outside the two conning towers. A 3 7-centimetre Hotchkiss gun is mounted on a pivot on the starboard side forward and another one on the after conning tower. There is a spacious saloon aft with two cabins, pantry, and w.c., the latter, as well as that of the crew, being supplied by Messrs. Stone & Co., of Deptford.

The vessel is lighted by electric light throughout, installed by the Brush Company with a 3-cylinder Willan's engine to drive the dynamo. There is a large protector of 6,000 candle power placed on the forward conning tower, and 20 incandescent lights are distributed over the different parts of the ship. This installation was made in the remarkable short time of eight days, and gave also very satisfactory results.

The propelling machinery, which forms a very important element in torpedo boats, was constructed at the Tegel (near Berlin) Engine Works of the builders, and consists of triple compound engines with three crank, which drive only the propeller. There is an independent compound engine to work the air and circulating pumps, which serves at the same time as feed and bilge pumps. Separate hand-feed pump and steam donkey are also provided, as well as direct in and outlets from the sea through the condenser.

The vessel is divided into eight water-tight compartments, and five of the larger ones have a steam ejector of 40 tons an hour each. The boiler is of the locomotive type, built entirely of German steel, except firebox, which is of copper with brass tubes, and works with 170 lbs. to the square inch, having been tested by cold water pressure to 240 lbs. A separate small engine drives a large fan for working the boiler under forced draught. The weight of the machinery, including water and all auxiliary engines as well as ejectors, steam steering gear, freshwater condenser, &c., does not exceed 34 tons, and everything worked on all the trials with perfect smoothness and ease, not the slightest hitch occurring. The builders expect a further order from the Spanish Government after arrival of the present boat at her destination.

HER MAJESTY'S SHIP "HOWE."

On January 14th, the *Howe*, armour-plated barbette ship of the *Admiral* class, of 9,600 tons displacement, concluded an exhaustive and very satisfactory series of engine trials in the Solent. Launched at Pembroke on April 29th, the fitting of the machinery on board was taken in hand by the contractors at the end of May, and she was brought round to Portsmouth under steam on November 14th, to undergo her official trials and complete for sea. Though the engines, however, were erected with remarkable despatch, the ship herself is little more than a mere shell, and it will take a long time to complete her equipment and internal fitments which really demand more thinking out than the construction of the hull. But, while necessarily light, she was for the purposes of the practical trials to which she was subjected immersed to her load draught by filling her double bottom and forward and after water chambers with water. By these means the vessel was brought down to 26 ft. 1 in. forward and 27 ft. 3 in. aft., thereby securing a mean draught of 26 ft. 8 in. During the trials, which were continued over three days, the *Howe* was under the command of Captain Tracey, of the Portsmouth Steam Reserve, the machinery being in charge of Mr. Robert H. Humphrys, of the contractors' firm, and among those who were officially present to observe the working of the engines and the behaviour of the ship under different rates of speed were Mr. James Wright, C.B., Engineer-in-Chief of the Navy, and Messrs. Sennett and Wildish, from the Admiralty; Mr. Alton, Chief Inspector of Machinery; Mr. Robert Barnaby, constructor; and Mr. Corner, of the Steam Department of the Dockyard. With the exception of the second day, the weather throughout the trials was boisterous, the wind blowing with a force of from six to seven, with a choppy sea.

The *Howe* is fitted with twin-screw vertical compound engines by Messrs. Humphrys, Tennant & Co., Deptford, on their well-known three-cylinder principle. Each set of engines has one high-pressure cylinder 52 in. in diameter, exhausting into two low-pressure cylinders 74 in. in diameter, supported in front by wrought-iron columns turned bright, and at the back by cast-iron frames which form the piston-rod guides. The stroke is 3 ft. 9 in. There are four brass condensers, two to each set of engines, 5 ft. 7½ in. in diameter, containing 4,250 ft. of cooling surface in each, and thus giving an aggregate of 17,000 ft. The air pumps (of which there are two to each condenser), buckets, and covers are made of brass, and are worked directly off the low pressure cylinders. The sole plates for carrying the crank shafts are made of steel, and are bolted on to box girders built into and forming part of the structure of the ship, thus forming a very light and strong foundation upon which the main engines are erected. The slides are of the usual double-ported description, and are worked by link motion with solid sectors. Being at right angles with the low-pressure ones, the high-pressure slide is actuated by a rocking lever. Automatic steam auxiliary engines, as well as hand gear, are provided for working the slides. The crank shafts are formed of hollow steel made in three interchangeable lengths, and fitted with automatic centrifugal lubricators. The general design of the engines is very simple, and all the moving parts are highly accessible. The platform arrangements have been well and carefully considered, and leave plenty of room everywhere for the accommodation of the engineering staff, a matter which, though of great importance, is, we fear, very often lost sight of. Another feature is the auxiliary condenser, for the purpose of condensing the steam used in the numerous auxiliary engines throughout the ship, and from which the condensed steam is pumped into the feed tanks and used for the main boilers. This arrangement enables the main condensers to be reserved exclusively for the use of the propelling engines, and insures a proper vacuum being maintained at all times. There are 12 boilers, made of Martin-Siemens steel, and designed to work at a pressure of 90 lb. on the inch. They are placed in four separate stokeholds divided by longitudinal and transverse bulkheads. Each boiler compartment is furnished with a double-cylinder feed pump. The forced draught fittings are arranged on Messrs. Humphrys' usual plan, the fans and engines for driving them being placed high up in the stokeholds. While accessible they are at the same time out of the way of the stokers. The manufacturers contracted to develop 7,500 I.H.P. with natural draught, and 9,500 H.P. under forced draught, with a moderate air pressure. These anticipations have been largely exceeded, as will be seen from the particulars below. These show the best results which have yet been obtained in vessels of the *Howe* class, and it will be observed that the I.H.P. per foot of fire-bar, which is perhaps the crucial test of performance, is very high.

The four hours' full-power trial with natural draught was completed on January 12th, when the following mean results were obtained, care being taken to limit the power indicated as nearly as possible to the contract power:—Steam in boilers, 88·25 lb.; vacuum, starboard 29·8 and 28·8 in., port 29 and 28·5 in.; revolutions, 94·3 starboard and 94·2 port; mean pressure in cylinders, 43·5 lb. high and 9·86 lb. low on the starboard side, and 44·4 lb. high and 10·2 lb. low on the port side; I.H.P., 3,810·51 starboard and 3,922·81 port, giving a collective power of 7,733·42 horses. The mean speed realized was 15 872 knots an hour, which was highly satisfactory. The coal consumption per unit of power per hour was 1·99 lb., which, as the bunker capacity is equal to the storage of 1,200 tons of coal, would enable the ship to steam eight days at a speed of 16 knots and to travel the distance from England to New York without easing her engines.

On January 7th, the *Howe* was put through an important series of trials on the measured mile in Stokes Bay, with open hatches, for the purpose of determining the curve of power at various speeds for the instruction of the Constructive Department. The runs were made at comparatively low rates of speed, but such as would be normally employed during a cruise, the whole of the boilers being used. Four runs with and against the tide were made. The ship is propelled by two four-bladed screws, having a diameter of 15 ft. 6 in. and a mean pitch of 19 ft. 5¼ in., and the first trial was intended to have been made at eight knots, but, as the ship went much easier than was anticipated, the estimated number of revolutions to secure the desired speed gave her, as will be seen, nearly a knot more than was expected. The results of the initial series were—First run, boiler pressure, 85 lb.; revolutions, 45·7 starboard and 43·7 port; collective I.H.P., 989·11; speed 8·6 knots. Second run, boiler pressure, 85½ lb.; revolutions, 54·5 and 53·1; H.P., 1,194·83; speed, 7·9 knots. Third run, boiler pressure, 85 lb.; revolutions, 53·4 and 51·5; H.P., 1,192·6; speed, 10·5 knots. Fourth run, boiler pressure, 82 lb.; revolutions, 53·2 and 51·6; H.P., 1,138·8; speed 7·4. Mean results, boiler pressure, 84·3 lb.: revolutions, 51·7 and 50; H.P., 1,128·8; speed, 8·937. The ship was next driven at 10 knots, with the following expenditure of power—First run, boiler pressure, 81 lb.; revolutions, 57·3 and 60; H·P., 1,588·3; speed, 12 knots. Second run, boiler pressure, 82 lb.; revolutions, 59·4 and 60·2; H.P., 1,657; speed, 8·6 knots. Third run, boiler pressure, 83 lb.; revolutions, 59·8 and 60; H.P., 1,782·2; speed, 11·5 knots. Fourth run, boiler pressure, 84 lb.; revolutions, 61 and 60·7; H.P., 1,783·4; speed, 9·2. Means, boiler pressure, 82·5 lb.; revolutions, 59·3 and 60·2; H.P., 1,702·3; speed, 10·2 knots. The final runs were made at 13 knots.—First run, boiler pressure, 83 lb.; revolutions, 79·5 and 79·7; H.P., 4,102·7; speed, 14·2. Second run, boiler pressure, 81·5 lb.; revolutions, 79 and 79·2; H.P., 4,066·6; speed, 12·8 knots. Third run, boiler pressure, 83 lb.; revolutions, 77·4 and 79·6; H.P., 4,084·1; speed, 13·5 knots. Fourth run, boiler pressure, 81·5 lb.; revolutions, 78·8 and 79·5; H.P., 4,096; speed, 13·4 knots. Means, boiler pressure, 82·25 lb.; revolutions, 78·7 and 79·5; H.P., 4,087·3; speed, 13·386 knots.

The final trial, and the most important one of the series, came off on January 14th, when the ship was steamed at full power under forced draught with closed stokeholds. As will be observed, some remarkable results were obtained. The run was continued for four hours, with the following half hourly observations:—

Boiler Pressure, lb.	Vacuum.		Revolutions.		Collective Power.
	Starbd.	Port.	Starbd.	Port.	
89	29·0	28·0	107·9	106·9	11,953·7
89	29·5	28·5	106·8	107·3	11,892·4
90	29·5	29·0	107·7	109·0	12,159·4
89	29·5	28·5	106·7	103·6	11,463·5
88	29·5	28·5	106·7	105·4	11,554·1
89	29·7	28·5	106·7	106·3	11,670·7
89	29·7	28·5	106·6	106·0	11,580·3
89	29·5	28·5	106·5	105·8	11,315·3

The means of the entire four hours gave the following results:—Steam in boilers, 89 lb; vacuum, forward 29·75 and aft. 28·87 inches on the starboard, and 27·78 forward and 28 inches on the port side; revolutions, 106·9 and 106·3 starboard and port respectively; mean pressures, 59·1 lb. and 14 lb. starboard, and 59 lb. and 13 lb. port engines; I.H.P., starboard 5,950·82 and port 5,761. These averages give a total collective power of 11,711·8 horses, being over 2,200 horses beyond the contract, and nearly 16 horses per foot of grate surface, the highest result yet obtained from any ship in Her Majesty service, and surpassing the performances of the *Rodney*, a sister ship, engined by the same makers. Gratifying, however, as was the amount of power developed, the result was not unexpected, as 12·086 H.P. had been obtained at a preliminary trial. The coal consumption amounted to 2·17 lb. per horse per hour, the rate of consumption enabling the *Howe* to steam for five days with her designed coal supply and to traverse about 2,000 miles at the mean speed realized. This was at the rate of 16·936 knots an hour, but it was evident to all on board that under more favourable auspices of weather she would have been able to do more. The engines worked without a hitch during the day, and there was no occasion for easing down the engines throughout the trial. There was an abundant and uniform pressure of steam, and there was little vibration from the screws. On the conclusion of the trial the *Howe* returned into harbour, and will be advanced to completion with all speed.

A NEW ARMOUR-PLATED SHIP.

THE first keel plates of a new armour-plated turret ship, to be called the *Trafalgar*, a sister ship of the *Nile*, which is to be built at Chatham, have been laid down at Portsmouth. The pieces of keel consisted of the central flat and vertical plates, forming the basis on which the whole structure of the vessel will rest. The flat keel is in two thicknesses, the lower or outer one being ¾ in. thick and the inner one ½ in., the vertical keel being also of the latter thickness. In one of his Edinburgh addresses, Mr. Childers claimed credit for the fact that during his naval administration the *Devastation* was designed, and that in 1870 a still further advance in naval architecture was made by the laying down of the *Dreadnought*, which he considered, and not without good reason, the finest ship in Her Majesty's Navy at the present time. In spite of the many varieties and types of battle ships which have been built since the launch of the *Dreadnought* and the laying down of the *Trafalgar*, the latest development in armour-clad construction will resemble his favourite ship in many important particulars. To say that she is an improved *Dreadnought* will signify little more than that she is a turret ship, that her turrets are built across the middle line of the ship fore and aft, that she will carry larger guns and thicker armour, and as a matter of course that she will have greater dimensions in order that this accession of weight may be floated. So far as her profile is concerned she will more closely resemble the vessels of the discredited *Admiral* class than the early turret ships; but as a matter of fact the *Trafalgar* is the first of a distinctly new type of protected fighting ships, and combines modifications of the special features of the *Dreadnought* and *Collingwood* class. Take away the barbettes of the latter and replace them by movable turrets, with a water-line armour belt, and something closely resembling the *Trafalgar* will be the result; or, to put the subject another way, add a superstructure battery between the turrets of the former, and a rough idea of the new ship will be acquired, differences of size being allowed for. The *Dreadnought* has a length of 320 ft., and breadth of 63 ft. 10 in., and a displacement of 10,820 tons, while the length of the *Camperdown* is 330 ft., her breadth 68 ft. 6 in., and her displacement 10,000 tons, the difference of the tonnage being due to the difference in the amount of side armour. As the *Trafalgar*, on the other hand, is not only intended to carry as powerful guns as the *Camperdown*, but to be protected by an armoured belt, her bulk is necessarily greater than either.

In length she will be 345 ft., while her beam will be 73 ft., her mean draught 24 ft., and her displacement 12,000 tons, so that she will be a larger ship than the *Inflexible*, which is 320 ft. long by 75 ft. broad, with a displacement of 11,400 tons. What engine power she will possess is not known, as the tenders have not yet been prepared, but she will be fitted for forced draught, and it is expected that she will realize a speed of 18 knots. She will be protected by broadside armour 20 in. in thickness, consisting of steel-faced plates, and this armour, while extending nearly the whole length of the ship, is much deeper than in vessels of the *Admiral* class. In modern turret ships the turrets are placed diagonally at opposite corners of the citadel, so as to obtain a simultaneous fire of all the guns ahead or astern, unobstructed by the light superstructures at the ends. In the *Trafalgar* there will be no forward and after superstructures, and the turrets, which

are to be 18 in. in armoured thickness, being built at the middle line at each end of the citadel, will have the advantage of practically unlimited training ahead and astern. These turrets will, of course, be able to fire either directly ahead or directly astern together, but with the great increase which has taken place in the power of the guns, the advantage which the battle ships of the *Colossus* class possess in this respect is more apparent than real. The fore turret will have a range of 45 degrees abaft the beam and the after turret a range of 45 degrees before the beam, giving each a training arc of 270 degrees. As regards the disposition and range of her turrets, the new ship resembles the *Dreadnought*, but she differs from her prototype in having a central battery between the turrets carrying eight 5-inch breechloaders, having a fair amount of protection, and a superstructure above, which, together with the battery, extends to the full breadth of the ship, and on which will be mounted a number of rapid firing 6-pounder and machine guns. Each turret will contain a couple of 66-ton B.L.R. guns, for which the weight of charge and projectile has not been settled. The torpedo equipment will be unusually large, as many as seven positions having been appropriated for discharging the Whitehead torpedo. Four will be under water, one at the bow, and the remainder above water on the broadside. It is confidently expected that the *Trafalgar*, when completed, will be the most formidable armour-clad either in our own or in any foreign navy. Some delay has occurred through a want of material, but it is believed that the vessel will be ready for launching in about two years. Four years will probably elapse, however, before she will be ready for the pennant.—*The Times.*

CLYDE SHIPBUILDING AND ENGINEERING

WORK DONE DURING 1885.

(*Continued from January Number.*)

CONTINUING our report on the twin industries which give a heading to this article, and before entering more particularly on the engineering part of the subject, we may briefly draw attention to one or two additional features of interest in the shipbuilding work done during the past year.

The very large number of small craft built during the year for a variety of services, must be said to be a distinguishing feature of the year's work. Reference has already been made to the very few high-class mail and passenger steamers turned out, and a table has been given exhibiting the comparative sizes of the 240 vessels produced. From it we gather that no fewer than 213 vessels, or 88·4 per cent. of the whole number, were under 2,000 tons gross, and not only so, but as many as 125 vessels, or 52 per cent. of the total, were below even so small a tonnage as 500 tons. The following orders, amongst others, contributed to the above result:—14 steel stern-wheel steamers, of 150 tons each, for the British Government (Egyptian campaign), by Messrs. Elder & Co.; 12 torpedo steam life cutters, about 5 tons each, for the Admiralty, by Messrs. Barclay, Curle & Co.; 4 steel sailing barges, of about 180 tons each, by Messrs. Lobnitz & Co.; and several teak launches, contracted for by Messrs. Ross & Duncan, for the British Government. Of these, and other much larger craft, a considerable proportion were not, in the usual sense, launched and fitted out by their builders, but were taken to pieces and shipped to their destination abroad, there to be reconstructed and completed. Messrs. Elder, with the 14 vessels for the Nile, and Messrs. Denny Bros., with 6 paddle steamers for the Irrawaddy Flotilla Company, were the largest contributors of this description of tonnage.

An interesting feature of the year's work, and one which indicates activity in the improvement of harbours and rivers, is the unusually large number of steam dredgers and hopper barges built. Doubtless the abnormally low prices reigning at present have been the inducements for harbour and dock authorities to strengthen and renew their dredging plant, but whatever the reasons, there can be no doubt that the fruits of the movement will be seen in improved harbour accommodation and increased facilities for navigation at the ports for which the several dredgers were destined. The number of dredgers turned out was 14, as many as 10 of which were hoppers and dredgers combined. Two hopper barges were also built. The firms taking part in this work were—Messrs. Simons & Co., Renfrew; Lobnitz & Co., Renfrew; Fleming & Ferguson, Paisley; and S. McKnight & Co., Ayr. The following are particulars of the vessels, together with the names of the port or harbour authorities for whom they were built.

DREDGERS BUILT DURING 1885.

Name and Description.	Gross Tonnage.	Ind. H.P.	For whom built.	Name of Builders.
"No. 4" Dredger	350	370	Aberdeen Harbour Commissioners.	Wm. Simons & Co.
Twin Screw Hopper Dredger "Surprise"	482	350	Enterprise Serrure, Dieppe ...	Do.
Hopper Dredger "Ville d'Eu" ...	482	350	Do. do.	Do.
Dredger "Melbourne"	706	800	Melbourne Harbour Commissioners.	Do.
Hopper Dredger "Leven" ...	856	900	Dumbarton Harbour Commissioners.	Do.
Hopper Dredger "No. 3" ...	866	900	Belfast Harbour Commissioners	Do.
Hopper Dredger "No. 4" ...	866	900	Do. do.	Do.
Hopper Dredger "Gefion" ...	460	350	Royal Danish Government ...	Do.
Screw Dredger "Drague XIX" ...	760	600	Panama Canal Company ...	Lobnitz & Co.
Screw Dredger "Dragueur 5" ...	680	390	Cie. Fives, Lille	Do.
Dredger "Gladstone"	300	300	Wick and Pulteney Harbour Trustees.	Fleming & Ferguson.
Dredger "India"	100	80	East India Railway Company ...	Do.
Hopper Dredger "Auckland" ...	600	600	Auckland Harbour Board, New Zealand.	Do.
Twin Screw Hopper Dredger "Kyle."	600	110	Ayr Harbour Trustees	McKnight & Co.

Though the combined hopper-dredger is comparatively a recent institution, the results attending it in every-day practical work are such as to encourage harbour and dock authorities to substitute it for the older dredge fleet, comprising fixed dredger, barges, punts, tug steamers, &c. The chief advantage of the hopper dredger lies in the fact that in one bottom, and with one crew, are combined all the properties of the older system, involving so many different items. Again, the combined system only takes up about one-third of the space occupied by the older dredge fleet, and this, as may be easily understood, is of the utmost importance to proper navigation in a confined channel. It has been proved that in several instances the cost of dredging and depositing by this system has been reduced one-half from that of the fixed dredger and attendant hopper barges. The first cost and upkeep of the combined craft are also found to be considerably less. The hopper-dredger "Forth," built in 1882, by Messrs. Simons & Co. (to whom properly belongs the great credit of introducing and building by far the greater number of these craft) owned by the Caledonian Railway Company, and at work on the river Forth, at Grangemouth, loads its hopper of 800 tons capacity in 2¼ hours, steams 18 miles to Granton in 2¼ hours, and returns in same time, although requiring to wait 3 hours on the tide making—Grangemouth being a tidal harbour. The "Forth" takes off 10 loads per week, equal to 8,000 tons, working double tides, with five additional hands over the usual day crew, the cost for wages, coals and stores, being under 2d. per ton. "No. 3" hopper-dredger, built in the early part of the year for Belfast, has dredged 1,800 tons in one day, and deposited the same 10 miles away, the working expenses in ordinary circumstances not exceeding one penny per ton. The

hopper-dredger "Kyle," built by S. McKnight & Co., and engined by Messrs. Fleming & Ferguson, also accomplishes, we believe, her dredging and discharging at the same remarkably low cost. Three of the most capacious and powerful hopper-dredgers yet constructed were those built during the year by Messrs. Simons & Co., for Belfast and Dumbarton. The "Leven" for the latter port, is 185 feet in length, by 38½ feet broad, by 15 feet moulded depth, with a hopper capacity of 850 tons, and is driven by twin screw engines, of 900 horse-power collectively, at a mean speed, when loaded, of 8½ knots per hour. Independent engines are fitted for closing the hopper doors; also for raising and lowering the bucket ladder, which latter feature in the three vessels under notice is on Messrs. Simons' improved patent traversing principle, for which they were awarded a silver medal at the recent Inventions Exhibition. The ladder is fitted to a traversing carriage, which enables the buckets to advance in front of the vessel, and so cut its own flotation through shoals and banks, enabling the vessel to be kept at work when otherwise it would be idle until the return of the tide. The "Leven" is capable of dredging 800 tons of soil per hour when working in sand, and can dig from a depth of 32 feet from the light-water line. The traversing arrangement, which may be seen in dredgers built by Messrs. Simons, and employed at Newhaven, Sussex, Grimsby, and other ports besides Belfast and Dumbarton, gives very general satisfaction.

With regard to engineering, we stated in closing the account of shipbuilding in last issue, that marine engineering was the necessary complement of steamship construction, and from information regarding the one, by easy inference knowledge could be had of the other. While this is true, still there are features of interest connected with engines purely which call for some notice. In the first place, a review of the work done in connection with steamship building would be incomplete without reference being made, however shortly, to several firms of repute who do not build hulls, but who nevertheless play an important part in turning out the machinery for steamships. Among these we may mention Messrs. John & James Thomson, David Rowan & Co., Rankin & Blackmore, James Howden & Co., Hutson & Corbett, Duncan Stewart & Co., William King, Kemp & Co., M. Paul & Sons, Ross & Duncan, and Dunsmore & Jackson.

The success attending the use of the triple expansion engines, measured roughly by the fact that at least 20 per cent. of saving in fuel is effected, has been reflected on the Clyde as elsewhere, by the steadily increasing number of engines of this description produced. This success has been so marked, that already it may be said the two-cylinder compound type of engine has been practically supplanted throughout the Clyde districts, as well as the shipbuilding districts of the north-east coast of England. We do not know of a single instance of a vessel of any considerable size being fitted with the older form of engine. Owners of steamships generally seem to have readily adopted the view taken of the triple expansion type of engines by Mr. A. S. Seaton, who in his paper on the "Triple Expansion Engine," read before the Institute of Naval Architects at its last meeting, spoke of it as "that form of engine which will undoubtedly help British shipowners to successfully tide over bad times, and keep the bulk of the carrying trade of the world in their hands." Experience with the triple expansion engine has encouraged at least two firms of engineers on the Clyde—Messrs. Denny & Co., Dumbarton, and Messrs. Rankin & Blackmore, Greenock—to go considerably further in the same line, and to produce quadruple expansion engines, one large set of which the former are now fitting in a steamer lately turned out from the shipyard of Messrs. Denny Brothers, while Messrs. Rankin & Blackmore are fitting their patent engines on board a large yacht lying in Messrs. John Reid & Co.'s yard, Port Glasgow. The latter engines have six cylinders, three cranks, and the boilers will have 180 lbs. pressure, a considerable advance on what the bulk of accepted authorities now consider necessary. The engines for Messrs. Denny's vessel are of the two-crank tandem arrangement, and, it is anticipated, will prove a considerable improvement upon even the best triple expansion engines now being made. By means of additional patents taken out by Mr. Walter Brock, the managing partner of Messrs. Denny & Co., it is intended still further to simplify and improve this type of engine. Indeed, this firm hopes in the near future to produce a quadruple expansion engine which, in the way of sea-working, will require no more labour in superintendence than the old compound e gine, and which will be, in accessibility to all its working parts, in no way inferior to that engine. The advantages obtained by such an arrangement, when coupled with diminished cost of production, decreased weight per horse power developed, and increased economy in the consumption of coal, must indeed prove considerable.

The keen pressure which the long existing dulness in trade has brought upon our engineering industry, has been productive of increased ingenuity in constructing economical engines and boilers in more directions than those of higher pressures and increased expansion of steam. The modes of combustion of fuel, and even the nature of the fuels used, have all been subject to close attention and experimentation. With regard to liquid fuel, the Clyde engineers have not as yet practically identified themselves with the movement now going on in connection with its adoption for the machinery of merchant ships, but in the matter of forced combustion it can be claimed for one of their number that he has been successful in demonstrating in every-day practice the immense advantages due to its use in sea-going cargo steamers. We refer to Mr. James Howden, of Messrs. Howden & Co., Scotland Street, Glasgow, the introduction of whose special system of forced combustion into one of Messrs. Scrutton, Sons & Co.'s vessels, has during the past year been more than justified in every-day working experience. The vessel in question, the *New York City*, has made four or five voyages to the West Indies and back, the results throughout being most satisfactory to all concerned. The consumption in this steamer has been reduced from 2·24 to 1·337 lbs. per I.H.P. per hour, by the substitution of a boiler fitted with the system under notice for one much larger, but worked by natural draught. This 1·337 lbs. per indicated horse power must be said to be an exceedingly low rate for ordinary compound engines working at 80 lbs. pressure, but it indicates the great economical value of this system of combustion. The paper read on the subject by Mr. Howden, before the Institute of Naval Architects at its last meeting, although considered by some to be almost extravagantly hopeful, is thus seen to be pretty fully justified by subsequent experience. From further savings which can yet be effected from the waste gases, &c., Mr. Howden, we understand, is assured of being able to give in ordinary working at sea a *bonâ fide* indicated horse power on 1 lb. of Welsh coal per hour! It is to be hoped that shipowners will afford the opportunities for further progress in what must be acknowledged to have already proved an efficient and convenient channel for economy in propulsion.

UNSINKABLE FISHING BOATS.—With a view to diminish the loss of life occurring with our fishing fleets—some of the vessels of which not infrequently go to the bottom with all hands in a very brief space of time—Mr. John White, the well-known boat builder, of Cowes, has designed a fishing vessel on lifeboat principles, which, he claims, will not sink if overwhelmed by the sea and filled with water. Already two of such vessels, of 30 tons, have been sent to the coast of Ireland, A model has been sent to Mr. F. Johnson, of 17, Parliament-street, well-known for his endeavours to diminish loss of life by shipwrecks, and it may be seen between the hours of 11 and 3 o'clock on presentation of a card, with bearer's name and address, at the private door, 72, New Bond-street, as well as some models of unsinkable and uncapsizable yachts' dingey and cutter, as adopted by Her Majesty's Navy and Coastguard.

A USEFUL INVENTION FOR STEAMSHIP CAPTAINS.—A board of naval officers tested the Baird Annunciators on board the Fish Commission ship *Albatross*, at Washington, on the 19th inst. The object of the invention is to indicate in the pilot house or elsewhere the fact as to whether the engines of a ship are in motion, and if so in what direction they are moving. This is accomplished by a pneumatic pressure acting upon the vanes of a delicately-constructed and sensitive fan, which is geared to and revolves a miniature crank upon a 6-in. dial in the pilot house. The air is compressed by an 8-in. blower belted to the shaft of the main engine, and is arranged to blow when the engine goes ahead, and to exhaust when the engine backs. A 1-in. lead pipe connects the blower with the Annunciator. The board reported favourably on the machines, and recommended their adoption by the naval service. The machines appear to be absolutely certain in their action, and are very prompt. On board a twin screw ship the Annunciators are invaluable; they not only relieve the commander of the task of remembering which engine is moving, but give him warning of any mistake that has been made, and ample time to correct it. A number of Annuciators may be attached to branch pipes, and must necessarily all indicate alike.—*Army and Navy Register.*

BUFFERS TO LESSEN THE EFFECTS OF COLLISIONS ON LAND AND SEA.

THE above is the title of a press copy of a patent specification forwarded to us by Mr. W. F. Stanley, of South Norwood, which we have been tempted to look into, although we much prefer to devote our editorial time to inventions that are developed by experiment into practical form (which we must, in the first instance, doubt whether this is) to any idea, however well formed. Nevertheless, having brought our mind to the reading of this specification, we found so much that appeared to us original, and that, if practical, was really important, owners and shareholders, and the loss of confidence to travellers, in certain lines, which have been most unfortunate, we understand at once how any floating straw on this troubled sea which can offer a hope of security would be clutched at, and we have no hesitation in saying that any invention which offers the prospect of some protection in this direction would be acceptable.

When we have made the above statement, we do not know how much security from collision Mr. Stanley may expect from his invention. If he anticipates that a vessel may steam upon a rock, or an iceberg, and that any buffer he may devise, that would not be a heavy burden to a ship, could resist the shock, we must conclude that he has not well studied the momentum of a vessel

FIG. 1.

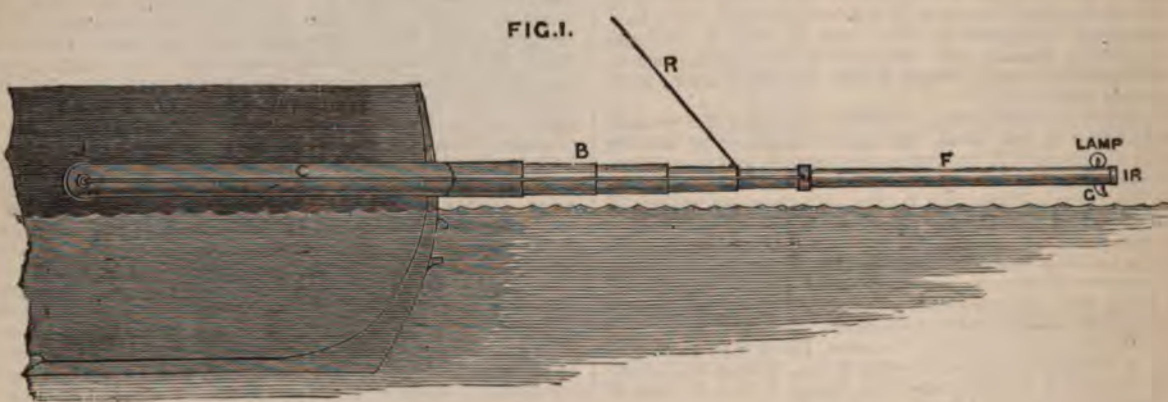
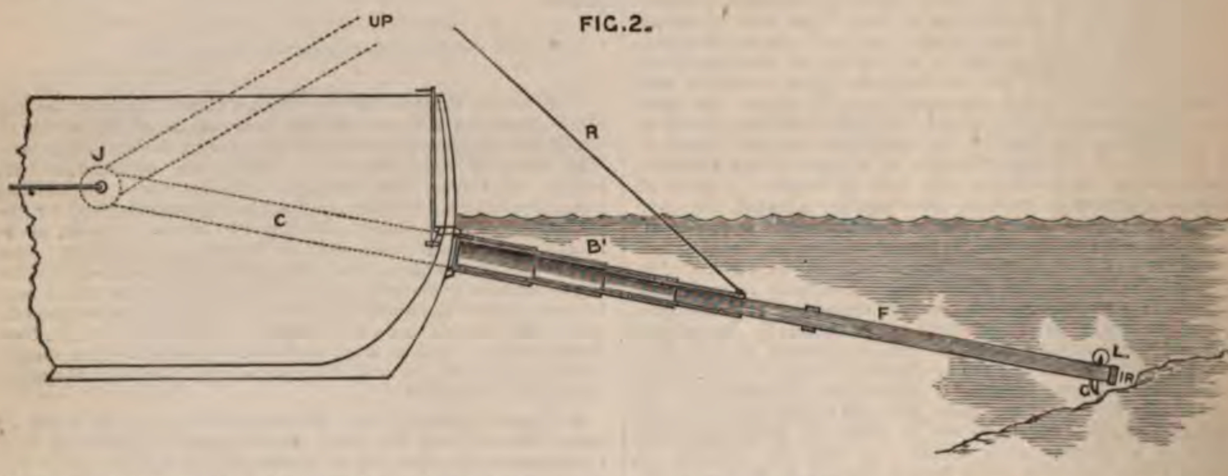


FIG. 2.



that we determined to bring the subject before our readers, whose experience we well knew could winnow the chaff from the corn, and find out what might be valuable in it. We may go a little further, and say we feel impressed that if the invention should be placed in the hands of one of our scientific shipbuilders, there is a great probability that a valuable issue may come of it.

We are not sure that the title given to this *idea* is a good one to convey any definite notion of the subject within the limits that we think it might be useful; we would suggest that "guard" would be better than "buffer," as at most this buffer could but guard a vessel from some of the worst effects of collision.

If we look over our long list of casualties from collisions at sea, the losses of money and confidence to under these conditions, or estimated the probable effects. But, on the other hand, we know that, in many cases, the skin of a vessel may be materially saved by the judicious and timely use of a few rope fenders, and we may therefore conclude that there must be a point where any more perfect buffer than the fender would be useful, or even in some cases valuable, to the extent of saving a vessel. Thus, although a vessel would certainly not be saved from an iceberg when steaming at full speed upon it, it might be protected if steaming very slowly, or a vessel might be protected from a sloping sandbank by the timely warning a first contact would give, and there are many other cases will strike one where any little help would be valuable.

The part of the invention before us which most

particularly concerns us, is the probable value of an elastic boom placed at the stem of a vessel, and the power of pointing this boom in any direction from which danger is likely to arise. The latter function appears to us most important. If we are in a fog in the neighbourhood of an iceberg, it is at the surface of the ocean danger is most likely to arise; whereas over shoals and near coasts it is the ship's bottom we want to save, and the power of directing this guard, as we would term it, in either of these positions we feel confident would, in many cases, be of service. With this preface we may leave Mr. Stanley to speak for himself, by extracting such portion of his specification as concerns us, or which may be of interest to our readers, hoping at some future time to have to record successful trials of his scheme.

FIG. 3.

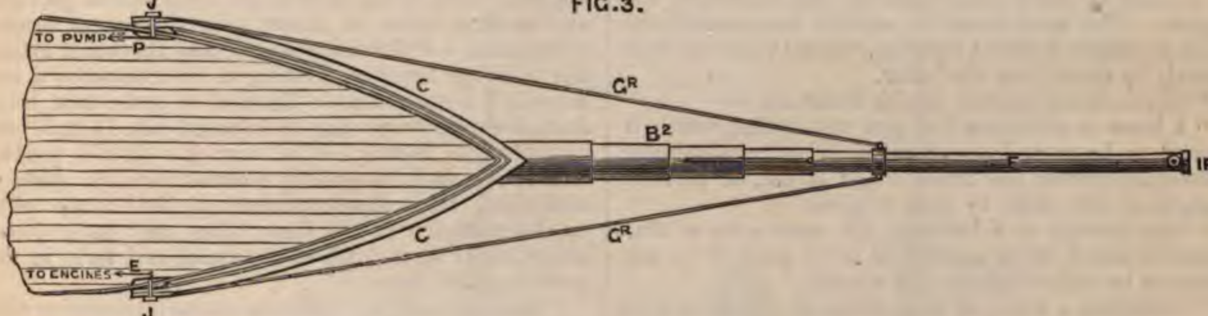


FIG. 4.

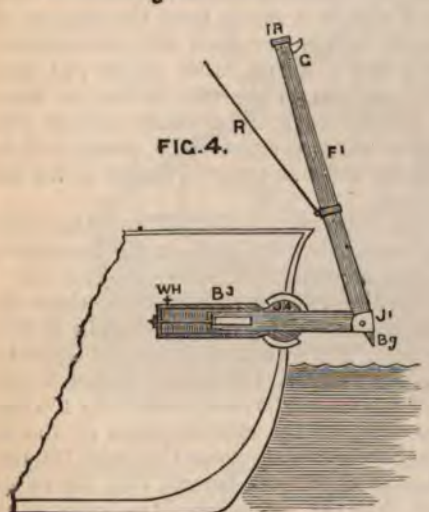


FIG. 5.

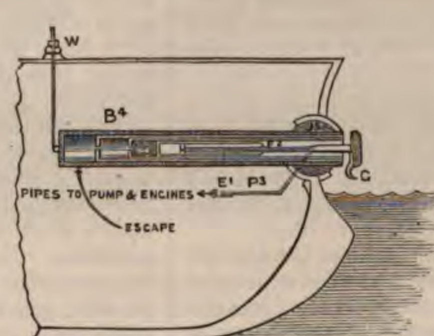
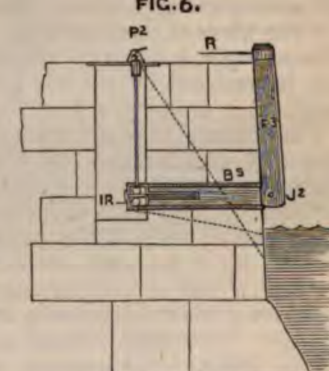


FIG. 6.



"The important difference between this and ordinary buffers on railways is, that whereas an ordinary buffer consists of a spring arrangement closely connected with a short piston, and a buffing head (the whole remaining fixed and immovable as a part of the locomotive or carriage), in this invention the buffer is made movable by a mechanical contrivance, which permits the part which represents the piston to be extended at will for a considerable distance in front of the spring arrangement. This extended part is to be used only in times of danger, the piston or shaft being made in such a manner that it may be withdrawn or made portable when out of use. The collision buffer will also have means of pointing it in any direction. There will also be communication with this buffer and the engines, to stop or reverse them. The details of this invention, which will be necessarily varied to adapt this buffer to special purposes, are as follows:—

"One part of this buffer will necessarily consist of a spring arrangement somewhat similar to that which has been applied to ordinary buffers, but in this case generally of much greater range of deflection, which will be either composed of steel springs, enclosed chambers containing steam pressure from the boiler, or compressed air, or water, or a combination of these, or chambers containing steam, or air, or water, and enclosing a bag or bags filled with india-rubber cuttings. The chambers or buffers will be generally combined in series, one behind the other, so as to produce the necessary range of spring, the deflection of which will be generally of as many feet as an ordinary buffer deflects inches. The essential mechanical arrangement of this part is, however, a spring, which may be produced by any known means.

"An additional part, not before used as buffers, is a long piston, or shaft, or *boom*, as hereafter termed, of wood or metal, placed in the fore part of the buffer. This boom may contain springs, or other elastic arrangements, and may be made in separate parts to slide one within the other.

"Part of this buffer consists of means of rendering the above described boom portable, which will be by turning it up by a joint at the position where an ordinary buffer terminates, or by sliding it in telescopically, or by a combination of these, one part sliding in and the head part turning up. It may be rendered portable by hand or power, and extended again by the same means.

"Part of this buffer consists of means of pointing it in any direction, which will be applied in the case of ships or vessels. This may be done by means of the joint described above, or may be done preferably by means of a second joint placed behind the turn-up joint. The head of the boom will be formed of an india-rubber pad on an ordinary buffer. The head will also, in case of ships, carry a hook and an electric light.

"Part of this buffer will consist of communication between the chambers of the buffer spring arrangement and the engines, and automatic brakes where these are used, to stop or reverse the engines at the instant of a collision. This may be done by any mechanical means, or by electricity, but prefer it done through a pipe or pipes, which will convey a pressure of the fluid in the chambers of the buffer to an inverse pump, which will act on a valve or other contrivance to stop or reverse the engines. The same pump or another may extend the boom to restore it after a collision, where this is not done directly by steam from the boiler.

"The novelties claimed for this buffer are :—

"A boom or additional fore-part to a buffer, which is jointed to be turned up or down, or to be withdrawn telescopically when the buffer is out of use, to make it portable at will, either by hand or power.

"The jointing of a buffer by the same joint as that described above, or by another, so as to point it to any direction to receive impact upon a solid.

"Producing a buffer of long range of deflection by a series of buffers, one behind the other, placing in the chambers of such buffers bags filled with india-rubber cuttings, or maintaining the long range of spring by steam pressure from the boiler.

"Communication with the buffer or its chambers to suitable mechanical apparatus to stop or reverse the engines.

"The whole of these novelties may be combined in one *collision buffer*, but two or four may be omitted, and three may be replaced by any suitable form of spring of the class used in ordinary buffers."

The manner of carrying out this invention is best shown by the drawings, of which the following is a description :—

"Figs. 1, 2 and 3 are of a collision buffer adapted to a vessel already built. Fig. 1, elevation ; fig. 2, vertical section ; fig. 3, horizontal section just above boom.

"B, B¹, B² buffing spring arrangement shown as telescopic chambers ; this chamber being otherwise filled with water and air. F F F boom, G hook to catch rocks, I R india-rubber buffer. Lamp shown above. C C C shears to connect the collision buffer to a position inward of the head of the vessel ; this part also acts as a spring. J J J J joint by which the buffer is directed in any vertical position, or turned up when out of use, as shown fig. 2 by dotted lines U P. G R guy ropes. R raising rope. P to pump to extend the buffer after a collision. E to engines to stop or reverse them.

"Fig. 4. Light collision buffer to new vessels. The joint J⁴ is placed at the head of the vessel to direct the boom. A second joint, J¹, permits the boom to turn up to make it portable. B⁹ is a buffer guard which acts only when the boom is turned up. W H is a warning whistle. The buffer spring, B³, is of coiled steel spring only.

"Fig. 5. Collision buffer for large vessels specially constructed for this buffer. In this the boom is wholly telescopic. B⁴ to withdraw within the vessel, the boom being extended either by a pump (pipe shown P⁸), or by steam direct from the engines, or compressed air. E pipe to stop or reverse engines. W winch to elevate or depress the buffer.

"Fig. 6 shows the collision buffer adapted to landing stages. The letters correspond with same parts in other drawings described. This form will also be used for the sides of vessels to buffer off tenders."

From these generalities, referring to Mr. Stanley for the details of one particular buffer, he selects that illustrated, fig. 5, which he describes as follows :—"I will assume this buffer to be composed of four wrought iron tubes, each 20 ft. long, bored and turned to leave a thickness of $1\frac{1}{2}$ in. of metal to bear with safety an internal pressure of say one ton to the inch. The largest tube connected with the vessel will be closed at the inner end. The smallest, or interior tube, will be closed at both ends. The outer ends of the three larger tubes will be provided with stuffing boxes or piston ring fittings, or leather collars as in a hydraulic press, so that the whole system will telescope together, forming at all extensions a stiff watertight compartment. The first or outer tube being fixed, the other tubes may be extended each 15 ft. beyond its outer tube, leaving 5 ft. of bearing. At this position each tube must be stopped by a chain from the inside or otherwise. Upon these conditions the head of the buffer, by the extension of the three tubes, may be projected altogether 45 ft. in front of the vessel, and form in this position a stiff boom.

"Now, assuming the hydraulic system is selected to work this buffer, it will require a pump from the engines, an elastic chamber (air bag, or one filled with india-rubber waste, I propose), and a spring valve, which will open with a pressure of one ton to the inch, to let the water escape from the interior when the pressure exceeds this. Such arrangements being complete, the pump will be applied to extend the buffer in times of danger to the full range of 45 ft.

"I have not yet discussed the diameters of the tubes, which, of course, would be regulated to the tonnage of the vessel, and the amount of security desired, but I may take a case to discover the resistance in which the inner tube, for convenience of calculation, shall be 11·3 in. in exterior diameter. The surface of the end will then be, near enough for our purpose, 100 square inches, which, upon a pressure of one ton to the inch, would offer 100 tons resistance. Now, suppose the elastic system of the air bag permitted the buffer to deflect one inch with 100 tons pressure, and that at a pressure beyond this the escape valve would open, then the resistance of the buffer would be for every inch of deflection 100 tons, and the entire resistance would be 45 by 12 by 100 = 54,000 tons, before the buffer could be pressed home to the vessel, deducted from the momentum of the vessel and the system of water which moves with it. Now, if the collision were upon a solid rock, or a large iceberg, the resistance would be entirely within the space of 45 ft., but if the buffer were in collision with another vessel, in the time the buffer would deflect 45 ft. the other vessel would be moving, and space would be given for the water to form also an effective resistance, assuming the engines stopped as proposed at the instant of collision."

THE sum of £160 has been voted for the making good of the steam steering of the *Polyphemus*, which has so completely broken down.

THE STEAM TRAWLERS "ESPERANCA" AND "FE."

WITH the exception of a coast lifeboat, we very much doubt whether any type of vessel in existence is subjected to so much rough usage and to so many severe strains as the modern steam trawler.

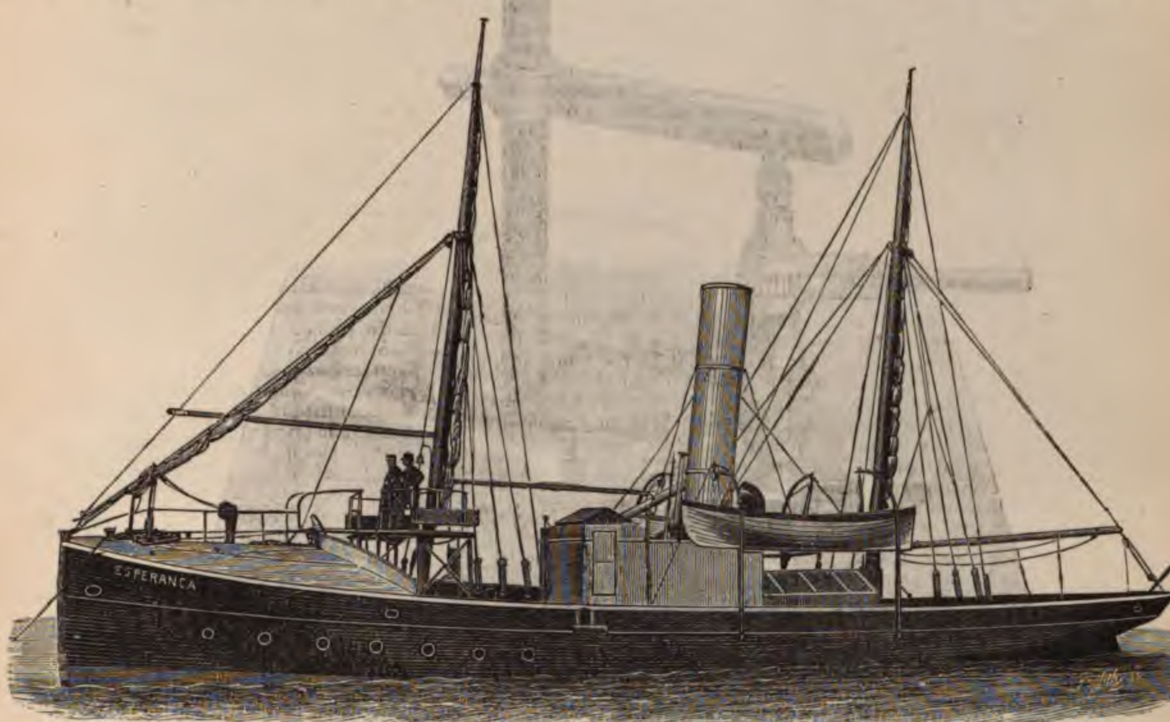
But the present almost perfect lifeboats of the Royal National Lifeboat Society, it must be borne in mind, are the outcome of many years experience and close study, while the steam trawler can only be looked upon as being, comparatively speaking, the product of to-day.

It therefore reflects the greatest credit upon the builders of the vessels now under notice, Messrs. Cochran and Co., of Birkenhead, to be able to say that the result of their labour, in what might be well called an almost entirely new field, has been extremely satisfactory to all concerned.

We now propose giving a detailed account of these vessels, the launch of which we briefly noticed in our issue for last September, while a summary of their trial trips appeared in the issue of the month following.

A reference to either of these notices will show that each vessel is 90 ft. long, 17 ft. beam, and 9 ft. deep, while the tonnage (builder's measurement) is in either case 115 tons, and as previously stated, they are intended for service on the coast of Brazil, to which destination they proceeded under their own steam.

These trawlers possess several features of interest, apart from the fact of their being the pioneers in a new and promising industry in that part of South America for which they were ordered. The vessels, the hulls of which were built of steel from the same model, the scantlings being fully equal to Lloyd's requirements, each one fitted with a turtle-back forward, and, as will be seen from our illustration, present a very handsome and ship-shape appearance.



The steering gear is carried forward and placed on the bridge, and telegraphic communication from the bridge to the engine-room, thus enables the man at the wheel to have entire control. The galley is placed amidships, and the crew are berthed forward, the officers' quarters are also forward of the machinery, and consist of a roomy, well-lighted, and well ventilated saloon; this extends the full breadth of the vessel, and from it two other rooms are entered.

The machinery of the two vessels is precisely similar in arrangement, but as the *Esperanca* has, in addition to her trawling duties, to act as tender between the fishing stations and the town of Para, she is provided with more powerful engines than the *Fé*, which will normally be employed for trawling only, the first-named vessel being fitted with a pair of inverted direct-acting compound surface-condensing engines, having cylinders 15 in. and 30 in. diameter, and 22 in. stroke, steam being supplied from a large steel boiler, having two furnaces. The *Fé* has similar engines, but the cylinders are only 13 in. and 26 in. diameter, while the stroke has been reduced to 18 in. At the trials the machinery proved capable of driving the vessels at speeds of 10½ and 9 knots respectively, and every part worked with perfect smoothness and regularity. The engines are very easily handled and can run at a sufficiently slow speed to ensure successful trawling.

Both vessels are supplied with every modern appliance for saving labour in working the heavy trawling gear, a powerful steam winch being provided in conjunction with veering bits and guide rollers in the bulwarks, while the after end of the beam is controlled by means of blocks

mounted on a strong davit on the quarter. The fish hold, placed abaft the machinery, is insulated in the most approved manner, and cooled so as to enable the fish to be preserved in a good and marketable condition, even in the hot, equatorial climate of northern Brazil. The refrigerating machinery is placed in the engine-room, and in each case consists of one of Lightfoot's Patent Universal Dry-air Refrigerators, of the vertical type, made by Messrs. Siebe, Gorman & Co., of London. These machines work with remarkable smoothness, and give promise of very successful results, the trials showing that the fish rooms could easily be reduced to below freezing point, with a couple of hours running.

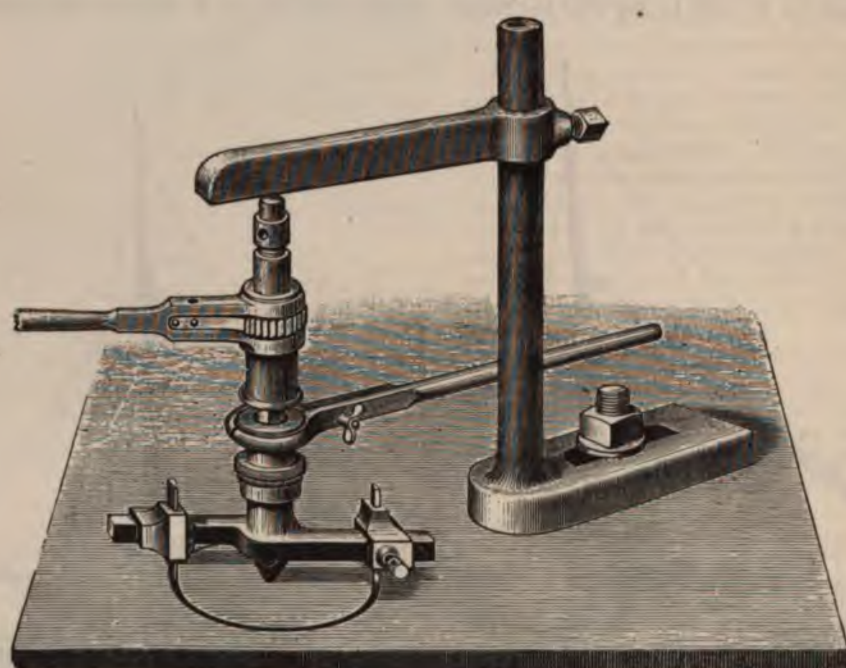


Fig. 1.

With the exception of the refrigerating machinery, the whole of the work throughout has been executed by Messrs. Cochran & Co., and needless to say, they have acquitted themselves well of their task.

R. KENT JONES' PATENT TUBE PLATE CUTTER, AND OTHER TOOLS.

We now have pleasure in calling the attention of our readers to two other useful appliances, designed and manufactured by Mr. R. Kent Jones, at the Eureka Works, Birkenhead.

These two tools, in common with those we described and illustrated in our last issue, will at once be seen to possess that great desideratum of all tools intended for the engine room, viz., strength, simplicity and compactness.

The Patent Tube Plate Cutter, shown at Fig. 1, though specially designed for use with a ratchet brace in the manner illustrated, is equally applicable for use in a drilling machine or lathe. The tool is extremely simple, and when used in conjunction with a ratchet brace the progress made is much quicker, and the work done superior to that effected by the ordinary centre pin drill. An indentation with a centre punch is all that is necessary for setting, and as there is no dead pressure on the cutting edge of the tool, little labour is expended, and there is less liability to break the cutters, which are simple in form, and easily adjusted to the diameter of circle required. The tool is fitted with a variable feed motion, which can be readily adjusted to the work in hand. Our second illustration (Fig. 2) shows Mr. Jones' patent portable annular cutter, for cutting elliptical or round holes in plate metal. The general arrangement and construction of the tool is sufficiently indicated by the drawing, and it therefore only remains for us to say, that it may be actuated by hand or steam power; further, that it cuts an ellipse as simply and as easily as a round hole, the tool or cutter, being controlled automatically in an oscillating tool box, which unfailingly adjusts itself to the increasing and decreasing angles when passing from the major to the minor axis. The tool is fitted with an automatic feed motion, and it is, without doubt, a thoroughly serviceable and efficient appliance.

We may perhaps here mention, that the Ratchet Brace described in our last issue, and the Tube Plate Cutter described above, won the Silver Medal for Mr. Jones, at the late Inventions Exhibition.

Miscellaneous.

The yacht *Galatea's* challenge for the American cup having been accepted, Mr. Edward Burgess, of Boston, the designer of the *Puritan*, has made arrangements for the building of a new yacht for General Paine, which, it is expected will be the defender of the Cup. Her modelling is something like that of the *Puritan*, but she is to be finer at the entrance. Her beam will be 22 3-10 ft. —the same as the *Puritan's*—and she will also have the same measurement outside. Her ballast will be about 27 tons. Her length over all will be 98 ft., and on the water-line 85 ft. The depth of her hold is to be 9 ft., and her draught 8 3-10 ft., the same as the *Puritan's*. The work of construction begins at once. Lawley & Sons, of Boston, are building her. They built the *Puritan*.

Dover and Ostend Mail Service.—Two new Channel steamers are in course of construction at Seraing for the Belgian Government for an additional daily mail service between Dover and Ostend. They will be much larger than the present boats, and somewhat after the model of the London and Chatham Company's new steamer. The length will be 255 ft., width 29 ft., across paddles 54 ft. 6 in., depth of hold 18 ft. 6 in. The registered tonnage will be 1,062 tons. They will draw 8 ft. of water, and will be driven by compound engines of 3,000 H.P., calculated to attain a speed of from 18 to 20 miles an hour. The vessels will be built entirely of steel. The whole of the after part of the deck below the bridge will be occupied by a saloon 60 ft. in length, for first class passengers, divided into separate compartments for ladies and gentlemen, and luxuriously fitted. The vessels will be provided with the electric light throughout. The modelling and fitting of the vessels are in accordance with suggestions of the King of the Belgians.

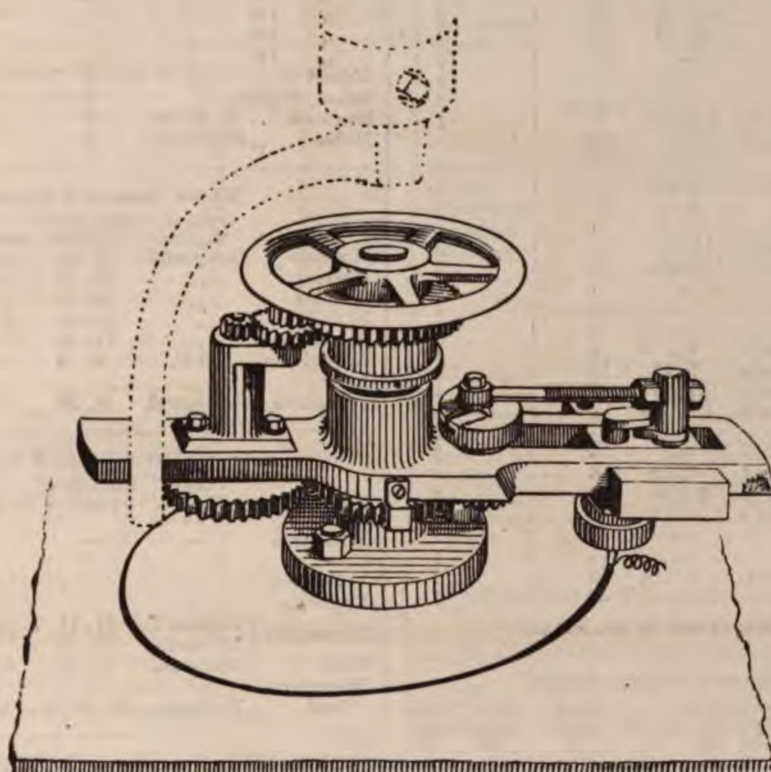


Fig. 2.

The *Times* quotes the following figures from the shipping returns in illustration of the economy in production by building larger vessels. In 1870 we employed 48,755 hands to work 1,039,000 tons of steam shipping, being an average of 47 hands for every 1,000 tons of capacity. In 1880 our steam tonnage had increased to 2,594,000 tons, and the number of hands employed to work it had advanced to 84,304; in this period there was a decrease of 15 hands, or about 32 per cent. in the number of hands required per 1,000 tons. Since 1880 there has been a further reduction of four hands per 1,000 tons of steam shipping employed, so that the total reduction has been 19 hands per 1,000 tons within the last fourteen years. In other words it required 70 per cent. more labour to work 1,000 tons of steam shipping in 1870 than it did in 1884.

Since the enactment of the Merchant Shipping Act in 1876, 591 vessels, nearly all of them sailing ships, have been detained for defects in hull or equipment; and 369 vessels, of which 364 were steamers, have been detained for overloading.

Postponement of the American Exhibition.—The executive council of the American Exhibition to be held in London have decided to change the date of opening from May 1, 1886, to May 2, in the following year. The chief reason for making this change is stated to be that the American Exhibition would clash with the Colonial and Indian Exhibition, the preliminary work in connection with which was entered upon long before that of the other.

The Admiralty have arranged with Messrs. Harland & Woolf to build two fast-steaming composite gun-vessels of a new type for the Royal Navy. The vessels will be similar to the *Swallow*, 8, which was recently launched. They will have a displacement of 672 tons, and will be fitted with engines of 1,000 H.P. Their armament will consist of six 5-in. steel breechloading guns and a strong equipment of Gardner and Nordenfelt guns and spar torpedoes. The other vessels of the same class, the *Wasp* and *Rattler*, are to be built by Messrs. Sir William Armstrong and Co.

LIST OF MARINE ENGINES AND BOILERS BUILT DURING 1885.

By Messrs. Ross & Duncan, Govan.

Name.	Class of Engine.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.
Turkish Vessel ..	Compound	28, 52	36	1	3
Excelsior	,,	19, 36	24	2	3
Launch	Duncan's	4½, 8	6	1	1
Yacht	Compound	10, 20	14	1	1
Dredger	Horizontal	10, 20	54	1	1
Launch	Duncan's	4½, 8	6	1	1
(Shipped)	Bremme's	7 single	8	1	1
Launch	Duncan's	4½, 8	6	1	1
Pointer	—	—	—	1	1
(Shipped)	Duncan's	3½, 6	5	1	1
Cambria	Compound	13, 24	18	1	1
Magic	,,	12, 24	18	1	2
Pluto	,,	14, 28	22	1	2
Quinta Hermoza	,,	14½, 28	22	1	2
Pelican	—	—	—	1	2
James Watt ...	—	—	—	1	2
Penquin	—	—	—	1	2
(Shipped)	Bremme's	6 single	7	1	1
Stern Wheeler ...	Horizontal	14, 14	28	—	—
Do. ...	,,	11, 11	22	—	—
(Shipped)	Bremme's	9 single	10	1	1
Do.	,,	9, 18	12	1	1
Winifred	H.P.	7, 7	8	—	—
(Shipped)	Compound	13, 24	18	1	2
Valletta	Bremme's	5 single	6	1	1
(Shipped)	,,	4 ,,	5	—	—
Clara	—	—	—	2	4
Aviles	—	—	—	1	3
Launch	Duncan's	4½, 8	6	1	1
Wawoon	Bremme's	8, 14	12	1	1
Launch	Duncan's	4½, 8	6	1	1
(Shipped)	Bremme's	4 single	5	—	—
Rio Gualeguay ...	—	—	—	1	2
(Shipped)	—	—	—	1	2
(For Liverpool) ...	Compound	5, 9	6	—	—
(Shipped)	,,	13, 24	18	1	2
Do.	Bremme's	6, 12	8	1	1
(For W. Scotland	—	—	—	1	1
* Do.	—	—	—	1	1
* (Shipped)	Tandem	9, 16½	18	1	1
Do.	—	—	—	1	1

All these are marine, except the two marked (*).

Messrs. Harland & Wolff, Belfast.

Name.	Class of Engines.	Diameter of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Köhinur ..	Compound	36, 72	48	3	9	90
Teneriffe ..	,,	32, 64	42	2	6	80
Elmina ..	,,	32, 64	42	2	6	80
Belgic ..	,,	43, 86	60	4	16	90
Gaelic ..	,,	43, 86	60	4	16	90
Costa Rican	,,	40, 80	51	2	12	100
Irene	T. Screw	28,28,56,56	36	2	12	80
Caloric ..	Compound	35, 70	45	2	8	100
Hugo	,,	37, 82	45	3	12	90
Chilian ...	T. Expan.	22, 33, 58	42	2	6	160

Earle's Shipbuilding and Engineering Company, Limited.

Name.	Class of Engines.	Diameter of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Eastwood ..	T. Comp.	19½, 30, 52	33	1	3	142
Eldorado ..	,,	26, 40, 68	39	2	4	150
Virgo	,,	11½, 17, 30	18	1	2	140
Libra	,,	11¼, 17, 30	18	1	2	140
Ariel	,,	23, 35, 60	57	2	4	150
Flamingo ..	,,	15½, 24, 40	24	1	2	140
Torpedo ..	,,	14¾, 22, 36	24	1	2	150
Alexandra ..	,,	11½, 17, 30	21	1	2	150
Witham ..	,,	11½, 17, 30	21	1	2	150
Holland ..	,,	11½, 17, 30	21	1	2	150
Kesteven ..	,,	11½, 17, 30	21	1	2	150
Lindsey ..	,,	11½, 17, 30	21	1	2	150

Messrs. Plenty & Son, Newbury.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Steam Yacht	Compound	11, 20	15	—	—	100
Yacht ..	,,	10, 18	15	—	—	80
Ida	,,	6, 11	8	—	—	80
Alcestis ..	,,	9, 16	12	—	—	80
Yacht ..	Screw	7	8	—	—	80
Sea Swallow	,,	6	6	—	—	100
Elfirda ..	,,	5	6	—	—	100
Trusty ..	,,	10½	13	—	—	100
To Bombay	,,	5¼	6	—	—	100
Steam Yacht	,,	4½	5	—	—	80
Pinnace, 178	,,	6⅝	6	—	—	75
,, 179	,,	,,	6	—	—	75
,, 180	,,	,,	6	—	—	75
,, 181	,,	,,	6	—	—	75
,, 182	,,	,,	6	—	—	75
,, 183	,,	,,	6	—	—	75
,, 184	,,	,,	6	—	—	75
,, 185	,,	,,	6	—	—	75
,, 186	,,	,,	6	—	—	75
,, 187	,,	,,	6	—	—	75
Export ..	,,	9	10	—	—	80
Steam Yacht	,,	6	6	—	—	80
Sunbeam ..	T. Screw	8	9	—	—	80
Mable ..	Horizontal	8	16	—	—	80

Messrs. Ramage & Ferguson, Leith.

Name.	Class of Engines.	Diameter of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Mascotte	Compound	32, 64	42	2	3	90
Malacca	,,	28, 54	36	1	4	80
Katrena	,,	22, 40	25	1	3	90
El Callao	,,	26, 50	36	1	3	80
Henry Venn	,,	14, 28	24	1	Loco.	100
El Atrivido	H.P.	9, 9	10	1	1	80
Lady Beatrice	Compound	18, 36	24	1	2	85

Messrs. David Rollo & Sons, Liverpool.

Name.	Class of Engines.	Diameter of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure
Madrid	—	—	—	2	6	80
Embericos	—	—	—	2	2	65
Great Western	—	—	—	2	3	65
Propontis	—	—	—	2	4	160
Mananense	Tandem T. Expansion	17, 17 38, 60	42	2	4	150
Basil	Compound	27, 55	39	1	4	90
Westmoreland	T. Expan.	20, 33, 54	36	2	3	150

Messrs. John Readhead & Co., West Docks, South Shields.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Woodcock ..	Compound	30, 60	30	2	6	100
Carlton ..	,,	32, 60	36	2	6	80
Treneglos ..	,,	30, 58	36	2	4	80
Trevean ..	,,	30, 53	36	2	4	80
Isle of Georgia ..	,,	28, 53	36	1	4	80
Grao ..	,,	30, 58	36	2	6	90
Carl Rahtkens ..	,,	30, 60	36	2	4	85
Richard Kelsall ..	,,	30, 58	36	2	4	85
Wm. Jolliffe	,,	30, 60	30	2	6	100
Linda ..		—	—	2	4	80
Ville de Lille	,,	—	—	1	3	80

By A. & J. Inglis, Glasgow.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Earl of Erne	Compound	37, 70	6ft 0in	2	8	90
Gen. Gordon	T. Expan.	26, 41, 60	3ft 6in	2	8	135
Patna ..	Compound	34, 62	3ft 9in	2	6	80
No. 192 ..	T. Expan.	27½, 44, 66	4ft 6in	2	12	160

By George Clark, Southwick Engine Works, near Sunderland.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Dordogne	Compound	26, 47	36	1	3	80
Henry Brand	,,	26, 47	36	1	3	80
Mequinez	T. Expan.	20, 23, 54	36	2	4	150
Octa	Compound	29½, 55	36	2	4	80
Palala	T. Expan.	21, 34, 56	42	2	6	150
Prince Edwd.	Compound	13, 26	18	1	3	90

The Fairfield Shipbuilding and Engineering Company, Limited, Govan.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Partha ..	T. Expan.	31, 50, 76,	4, 6	2	12	150
Batavia ..	,,	23,26,26,58	3, 6	1	6	150
Bangkok ..	Compound	15,15,30,30	1, 6	1	2	100
Ibis.. ..	,,	13, 24	4, 0	1	1	160
13 Steamers	,,	12, 22	3, 6	1	1	160
Pres. Meyer.	T. Expan.	44, 70, 108	6, 0	6	36	150

Palmer's Shipbuilding & Iron Company, Limited.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
—	Compound	30, 57	39	2	6	80
Mount Olivet	,,	36, 68	48	2	6	80
Surprise ..	TwinScrew	26, 50	34	4	10	100
Alacrity ..	,,	26, 50	34	4	10	100
James Joicey	T. Expan.	16½, 26, 43	36	1	3	150
J. R. Hinde	,,	16½, 26, 43	36	1	3	150
K. of S. John	,,	27, 44, 71	48	2	12	150
Kt. Errant..	,,	27, 44, 71	48	2	12	150
Buffalo ..	,,	33, 54, 86	60	4	18	160
Cabo Finesterre ..	,,	19, 31½, 51	36	2	4	160
Flamboro' ..	,,	22, 35, 58	42	2	6	150

Messrs. Laird Bros., Birkenhead.

Name.	Classs of Engines.	Diameter of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Pylades ..	Horizontal	35, 58	3 ft.	4	8	90
Seine ..	Vertical C.	32, 64	4 ft.	3	18	80
Ireland ..	Vertical O.	102	8ft 6in	8	32	30
Britannia ..	T. Screw	26, 45	2ft 6in	2	6	75
Stormcock	,,	26, 45	,,	2	6	85
Blackcock	T. Expan.	19, 28, 47½	,,	1	4	150
Boilers only.						
Ulster ..	—	—	—	4	24	25
Columbus ..	—	—	—	1	4	35

Thomas Richardson & Sons, Hartlepool.

Name	Class of Engines.	I.H.P.	No. of Boilers.	Pressure.
Bempton	Compound	1,000	2 Single Ended	75
Ching-wo	T. Expansion	1,650	2 Double ,,	140
Swiftsure	,,	950	1 ,, ,,	140
Greystoke	,,	1,100	2 Single ,,	140
Algoma	,,	1,650	2 Double ,,	140
Raphael	Compound	1,000	2 Single ,,	75
Wells City	T. Expansion	1,100	1 Double ,,	140
Beresford	,,	1,100	2 Single ,,	150
Shakespeare	,,	1,050	2 ,, ,,	145
Heliades	,,	1,550	2 Double ,,	150
Washington City	,,	1,200	2 Single ,,	140
Chelydra	,,	1,450	2 Double ,,	145
J. M. Smith	,,	1,150	1 ,, ,,	140
Anglian	,,	1,500	2 ,, ,,	150
Stella	,,	1,200	2 Single ,,	145
Kai-sou	,,	2,550	2 Double ,,	145
African	,,	1,050	2 Single ,,	150
Dock Engines	Compound	400	1 ,, ,,	75
,,	,,	400	1 ,, ,,	75

Robert Stephenson & Co., Newcastle-on-Tyne.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Palamed ..	Compound	27, 58	60	1	6	80
Prometheus	,,	27, 58	60	1	6	80

Messrs. Wigham, Richardson & Co., Newcastle-on-Tyne.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Sitona..	Compound	30, 58	36	2	4	80
Buccaneer ..	,,	30, 61	39	1	6	100
Foxhall ..	,,	30, 61	39	1	6	100
Haiphong ..	,,	31, 62	42	2	6	90
Norge.. ..	,,	30, 58	36	2	4	80
Flora	,,	25, 48	33	1	3	80
Baghdadi ..	T. Expan.	21½, 33, 55	39	2	6	150
Restitution..	,,	29, 44, 74	48	2	12	150
Formosa ..	,,	20½, 32, 53	36	2	6	150
Hispania ..	,,	20, 31, 52	36	2	4	150
Port Victor..	,,	27, 42, 70	48	3	12	150

Messrs. J. W. & F. Wilson & Co., Sunderland.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Expedit ..	—	20, 38	30	1	2	80
Edgworth ..	—	27, 50	36	1	3	80
No. 86 ..	—	28, 53	36	1	3	80

Messrs. Muir & Houston, Glasgow.

Name.	Class of Engine.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Kenilworth	Compound	21½, 42	30	1	2	85
Tartar ..	,,	21, 40	27	1	2	80
Northward..	,,	21, 42	27	1	2	90
Dunrobin ..	,,	21, 40	30	1	3	90
(Shipped) ..	,,	13½, 23	18	—	—	—

Wallsend Slipway & Engineering Co., Limited, Newcastle-on-Tyne.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Barrumbeet	Triple	23, 33, 60	42	2	—	150
Corangamite	,,	23, 33, 60	42	2	—	150
Mary Nixon	,,	16½, 26, 43	36	1	—	150
Haswell ..	,,	16½, 26, 43	36	1	—	150
Eveline ..	,,	18½, 31, 50	36	2	—	160
Dragoman ..	,,	24, 39, 64	42	2	—	150
Corriere di Rome ..	Compound	14, 25	18	1	—	80

North Eastern Marine Engineering Company, Limited, Sunderland.

The above Company have engined the following vessels:—

Name.	N.H.P.
Offerton ..	90
Heathpool	110
Gian Paolo	70
Semeramis	70
Bradley ..	70

Messrs. Rankin & Blackmore, Greenock.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Hercules ..	Compound	23, 42	30	1	3	80
Black Pearl	,,	19, 36	24	1	2	80
Rionnagna Mara	Q. Expan.	7, 7, 7, 16, 22, 34	24	1	2	180

Messrs. John Cran & Co., Leith.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Alice ..	Compound	8, 15	12	1	—	90
Malektijar ..	,,	5, 8	7	1	—	85
Osprey ..	,,	8, 15	12	1	—	90
Petrel ..	,,	8, 15	12	1	—	90
Venture ..	,,	—	12	1	—	90
Bull ..	,,	—	12	1	—	60
Merlin ..	,,	8, 15	12	1	—	90
Fulmar ..	,,	8, 15	12	1	—	90
Evelyn ..	,,	8½, 12	12	1	—	100
Perseverance	,,	8, 15	12	1	—	90

Messrs. C. D. Holmes & Co., Hull.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Victory	.. Compound	12, 22	18	1	2	85
City of Chester ..	,,	14, 26	20	1	2	80
Irrawaddy ..	,,	17, 33	22	1	2	90

Mr. W. Kemp, Govan.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Nina ..	H.P.	7	7	1	1	60
Dolphin ..	,,	12	11	—	—	—
Alert	.. Compound	20, 38	24	1	2	80
Jacaro ..	,,	—	—	1	2	60
Eprito ..	,,	7, 13	9	1	1	80
Elf	,,	7, 13	9	1	1	80
No. 59 ..	,,	7, 13	9	—	—	90

Messrs. Hutson & Corbett, Glasgow.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Primrose	.. Compound	17, 32	22	1	2	80
Moiaira ..	,,	27, 54	36	2	6	90
Seimado ..	,,	14, 28	21	1	2	85
Degrave ..	,,	14, 28	21	1	2	85
Waverly ..	Paddle	52	60	1	4	50
Sunbeam	.. Compound	10½, 21	12	1	2	80
Tertia	,,	14, 28	21	1	2	85
Le Glorieux	,,	14, 28	21	1	2	85
Jessie	,,	14, 28	21	1	2	85
Gran Canto	,,	14, 28	21	1	2	85

Messrs. Kincaid & Co., Greenock.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Mergui	.. Compound	18, 36	27	1	2	90
Ossian	,,	12, 24	18	1	2	100
Guy Fawkes	,,	10, 20	15	1	1	70
Maule	,,	16, 32	20	1	2	100
Polar Light & Acolite ..	Non-cond. S Cylinder D. Acting	13	14	—	—	—
Daylight & Chrysolite ..	,,	10 10	12 12	—	—	—

Central Marine Engineering Company, West Hartlepool.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Enfield	.. T. Expan.	21, 35, 57	39	2	6	160

Messrs. John & James Thomson, Glasgow.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Princess Royal ..	—	32, 57	4 ft.	—	6	90
Hibernian ..	—	38, 75	4ft 6in	—	12	90
Laura ..	—	33, 64	3 ft.	—	6	100
City of London ..	—	52, 89	4 ft.	—	12	75
Manitoban ..	—	45, 78	3ft 6in	—	8	75
City of Bombay ..	—	50, 96	5 ft.	—	18	90

Messrs. Hawks, Crawshay & Sons, Gateshead-upon-Tyne.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Springhill ..	—	21½, 40	30	—	—	—

Messrs. John Dickinson, Sunderland.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Bavington	.. Compound	32, 62	39	2	6	85
Brixham ..	,,	24, 48	33	1	3	90
Royal Prince	T. Comp.	20, 33, 54	39	2	6	150
Ocean Prince	,,	20, 33, 54	39	2	6	150
Tunstal ..	,,	25, 40, 66	45	2	8	150
Pinillos ..	,,	25, 40, 66	45	2	8	150

Messrs. Cox & Co., Falmouth.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Norman	.. Compound	10, 18	14	2	—	95
Empress	.. Twin Com.	10, 18	14	3	—	90
Challenger	.. Compound	16, 30	21	3	—	85

Messrs. Carr & Co., Limited, Sunderland.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Countess	.. Compound	33, 62	42	2	6	100
Nordeu ..	,,	27, 50	36	1	3	80
Racer	.. T. Expan.	15, 23, 40	27	1	3	150

Messrs. Alex. Shanks & Son, Arbroath.

Name.	Class of Engines.	Diam. of Cylinder.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Condor	.. Compound	20½, 40	24	1	2	80
Shannon ..	,,	20½, 40	24	1	2	80
For Spain ..	,,	13, 24	18	—	—	—
Colonial ..	,,	12, 22	18	—	—	—
Colonial ..	,,	12, 22	18	—	—	—
British ..	,,	12, 22	18	—	—	—
Cornwallis ..	,,	20½, 40	24	—	—	—
For Spain ..	,,	9, 18	14	—	—	—
Foreign ..	,,	11, 12	18	1	1	100
Eagle	,,	23½, 47	27	1	3	100
Foreign ..	,,	9, 18	10	1	1	100
Colonial ..	,,	9, 18	14	1	1	100
Waikna ..	,,	9, 18	14	—	—	—
Colonial ..	,,	9, 18	14	—	—	—

Messrs. Duncan, Stewart & Co., Glasgow.

Name.	Class of Engines.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
Kimberley..	Compound	44, 82	4ft 6in	2	6	90

Messrs. Westgarth, English & Co., Middlesbro-on-Tees.

Name.	N.H.P.	Diam. of Cylinders.	Stroke.	No. of Boilers.	No. of Furnaces.	Pressure.
St. André ..	60	20, 39	27	1	2	90
St. Jean ..	50	18, 36	24	1	2	80
Sir Rbt. Peel	50	18, 36	24	1	2	85
Donegal ..	50	18, 36	24	1	2	85
For export..	15	9, 18	9	—	—	—

Now in hand—170 N.H.P., 22, 35, 57 by 42, 150 lbs.; 160 N.H.P., 22, 35, 57 by 39, 150 lbs.; 145 N.H.P., 20, 33, 54 by 36, 160 lbs.; 50 N.H.P., 18, 36 by 24, 85 lbs.

Messrs. Jensen & Co., Birkenhead.

1. Pair of high pressure screw engines, 8 H.N., Jensen's patent, built for Captain Davies, River Dee Company.
2. Pair of high pressure paddle engines, 9 H.N., Jensen's patent, built for Messrs. Beesley & Sons, Barrow-in-Furness.
3. Pair of compound 8 H.N., Jensen's patent, built for Mr. Leeming, Liverpool.
4. Pair of high pressure screw engines, 8 H.N., Jensen's patent, built for Mr. William Dickinson, Birkenhead.
5. Pair of high pressure screw engines, 8 H.N., Jensen's patent, built for Messrs. Ewing & Co., Birkenhead.

German Fittings for Clyde-built Ships.—For the first time since the North German Lloyd have placed contracts in Clyde shipbuilding yards, they have, in case of the vessels now building to their order at Fairfield, arranged that the internal fittings, such as cabin upholstery, &c., shall be done in Germany. This resolution will tell upon several important industries in the west of Scotland. It is calculated that the money va ue of the work to be done in Germany is not less than £30,000.

Steam Steering Gear.—Messrs. Yarrow & Co. recently had a first trial of one of the twenty-four torpedo boats they are building for the English Government, especially to test the new steam steering gear fitted by Messrs. Davis & Co., of Porlar. The results obtained were very satisfactory.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of The Marine Engineer *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—Ed. M. E.]

LAUNCHES.—English.

Kaisow.—On December 22nd a steel steamer of 3,000 tons register was launched from the shipbuilding yard of Messrs. Joseph L. Thompson & Sons, North Sands, Sunderland. This vessel, which has been built to order, forms the latest addition to the fleet of the China Shippers' Mutual Steamship Company, London, trading regularly between that port and China. Her length is 362 ft., breadth 41 ft., and depth 24 ft. 6 in. She has the highest class at Ll yd's under the three-deck rules, with long bridge deck amidships enclosing cabins, and having water ballast fore and aft on the cellular system. Every modern improvement has been introduced in the construction and equipment of the vessel. The engines are of the triple expansion type, by Messrs. Thomas Richardson & Sons, of Hartlepool, of 2,400 I.H.P., and are calculated to give the vessel a speed of 13 knots. She is also fitted with teak decks, direct steam windlass, double steam winches, steam steering gear, and steering telegraph, and will have accommodation for a limited number of first-class passengers, a Board of Trade certificate having been provided. Among the visitors were Mr. Robert Deacon, Chairman of the China Shippers' Company; Mr. David Reid, Director; Mr. Stewart, Director; Mr. Hunter, of Foochow; Mr. Tone, Mr. John Thompson, Captain Thomson, and other gentlemen, and a number of ladies were also present. The vessel on leaving the ways was very gracefully named by Miss Deacon the *Kaisow*.

Romulus.—On December 24th Messrs. Cochrane & Co. launched from their shipyard at Grovehill, Beverley, a steam trawler, for Messrs. Pickering & Haldane, of Hull. The ceremony of naming the vessel (the *Romulus*) was performed by Miss Cochrane. The *Romulus* is the first of four steam trawlers now building for Messrs. Pickering & Haldane. Her principal dimensions are:—Length of keel, 105 ft.; breadth, 20 ft.; depth, 12 ft. The vessel is built with rake stem, raised quarter deck, and forecastle. She is to be fitted with patent windlass, worked by messenger chain from a steam winch. Her engines are to be supplied by Messrs. C. D. Holmes & Co., of Hull, and are compound surface condensing, 45 N.H.P.

Kingfisher.—On December 30th there was launched from the yard of Messrs. J. Knox & Co., South Hylton, an iron screw steamer of the following dimensions:—Length, 110 ft.; breadth, 19 ft.; depth, 10 ft. 6 in. The vessel has been built under special survey, and will be classed 100 A 1 at Lloyd's. She has been specially designed as a fish despatch vessel and screw tug, and will be fitted up with all necessary arrangements and improvements for bringing her cargo safely and speedily to market. She has flush iron main decks, with accommodation for captain and officers aft. The crew will be berthed in a raised forecastle. A powerful steam winch has been placed at the fore hatch, which will work one of Fisher's patent windlasses for ground tackle. The engines have been constructed by Messrs. Doxford & Sons, Pallion, and are on the compound surface-condensing principle. They are of 350 H.P. The vessel is intended for the Irish deep sea fisheries, and as she left the ways she was christened *Kingfisher* by Mrs. John Thompson, jun., of Sunderland.

Azalea.—On January 2nd there was launched from the yard of the Sunderland Ship Building Company, Limited, a finely modelled screw steamer, built to the order of Messrs. Leach & Co., of London. The vessel is built to take the highest class at Lloyd's under special survey, and her principle dimensions and particulars are as follows:—Length, B.P. 162 ft. 6 in.; breadth, 23 ft. 6 in.; depth of hold, 12 ft. 6 in; having raised quarter deck, bridge and top gallant forecastle, three steam winches, by Messrs. Clarke, Chapman & Co., and Harfield's patent windlass. The machinery will be supplied by the North Eastern Marine Engineering Company, Limited, having cylinders 20 and 40, by 27 stroke, 90 lbs. pressure. The vessel has been specially designed for the owners, London and Ghent line. On leaving the ways she was named the *Azalea*, by Miss Hands.

Bawean.—On January 4th there was launched from Mr. James Laing's shipbuilding yard, Deptford, Sunderland, a steel screw steamer, built to the order of the Netherlands India Steam Navigation Company (Limited), of the following dimensions, viz.:—210 ft. by 30 ft. 3 in. by 14 ft. (depth of hold), classed 100 A 1 at Lloyd's, having a long full poop, citadel house, and topgallant forecastle. The vessel, when completed, will be added to the company's line for the conveyance of cargo, passengers, and troops between the ports of Java and other ports in the Netherlands India. She will be fitted up for 20 first and second-class passengers. The poop and main decks are of East India teak. The fore 'tween decks will be fitted up for the conveyance of troops. A large gunpowder magazine, mail and bullion rooms, scullery, bakery, bath rooms, and lavatories, &c., will also be fitted on board the vessel. The winches, donkey boiler, and windlass have been supplied by Messrs. Clarke, Chapman, Parsons & Co. The engines, which have been constructed, together with the vessel, under the inspection of Lloyd's, the Board of Trade, and Dutch Government Inspectors, are of the tri-compound type, and built by Mr. George Clark, Southwick Engine Works. The pressure of the boilers is 150 lbs. These are expected to drive the vessel at a high rate of speed. During construction the ship and engines have been under the special superintendence of Captain Van Emmerik, who has been for over 22 years in the company's service, and is now the commodore of their fleet. On leaving the ways the vessel was named the *Bawean* by Miss Quinet.

Racer.—On January 15th there was launched from the shipbuilding yard of Messrs. Boolds, Sharer & Co., Pallion, Sunderland, a steel screw steamer, built to the order of Messrs. Watkins & Co., London. Length over all is 126 ft.; breadth, 20 ft. 2 in.; depth of hold, 12 ft. 6 in. She has been specially designed for a very high rate of speed and powerful towing purposes. The engines, which are from the engine works of Mrs. Carr & Co. (Limited), are of the most modern tri-compound surface-condensing type, of about 400 I.H.P. On leaving the ways the vessel was christened the *Racer* by Miss Maud Young, of Stockton.

Iron Screw Fishing Trawlers.—On January 18th the Earle's Shipbuilding and Engineering Co., Limited, launched from their yard at Hull two iron screw fishing trawlers, built by them for the Boston Deep Sea Fishing and Ice Co., Limited. Their dimensions are 85 ft. by 19 ft. 9 in. by 10ft., with flush deck aft and small raised forecastle forward. They are built to Lloyd's 90 A1 class. The accommodation for captain and officers is aft, and that of the crew in the forecastle; the whole of the remaining space clear of the engines is fitted for the storage of ice and fish. The vessels are ketch-rigged with pole masts, and are fitted with a powerful steam winch of Earle's special design and make for working the trawl gear. They will be fitted by the builders with direct-acting inverted compound engines having cylinders 12 in. and 22 in. diameter by 20 in. stroke, which will be supplied with steam of 90 lbs. pressure from a steel boiler with one of Fox's corrugated furnaces.

Landrail.—On January 19th this new gun torpedo vessel, 385 tons, and 1,200 H.P., was launched from Devonport Dockyard. The *Landrail* is a sister ship of the *Curlew*, which was recently launched from an adjoining slip, and she is only the second of an entirely new class of gun and torpedo ship designed by the Constructive Department of the Admiralty. She has been twelve months building, and the attainment of a high rate of speed has been especially aimed at by her designers. For this purpose she has extremely fine lines at both stem and bow, and has been built, her boilers and machinery included, entirely of steel, the substitution of steel for iron reducing the weight of the ship by one-third. She is fitted with the electric light, and will be armed with one 6-inch and three 5-inch breechloading guns, besides two Nordenfelts, two Gardners, and torpedo-launching apparatus. The vessel was launched with the whole of her boilers and machinery on board, and this will facilitate her completion for the pennant by about three months.

Earl of Jersey.—On January 19th there was launched from the building yard of Mr. Joseph T. Eltringham, Stone Quay, South Shields, an iron paddle tug, the dimensions being 108 ft. by 18 ft. 6 in. by 9 ft. 9 in. The vessel, which is of the most modern and approved type, will be fitted with a single side-lever surface condensing engine of 75 H.P., steam for which is supplied

by a large multitubular steel boiler working at 45 lbs. pressure, the paddle wheels being on the feathering principle. The vessel is named the *Earl of Jersey*, and has been built to the order of Messrs. J. P. Rennoldson and Sons, of South Shields, who will supply the machinery. She is intended for the towing trade in the Bristol Channel, her owners being Messrs. Martin & Marquand, of Cardiff.

Eskasoni.—On January 20th, Messrs. Richardson, Duck & Co., launched from their building-yard, a fine iron sailing ship, of the following dimensions:—Length over all, 272 ft.; breadth extreme, 39 ft.; depth in hold, 23 ft. 9 in.; tonnage, about 1,750 tons. This vessel which has been built to the order of Messrs. T. & E. Kenny, of Halifax, Nova Scotia and London, is classed 100 A1 on Lloyd's registry, and has been built under special survey. She has a full poop for the accommodation of Captain and Officers, a topgallant forecastle, and a deck-house amidships for crew, galley, etc., and will be rigged as a full rigged ship with all modern improvements. As the vessel was leaving the ways she was christened the *Eskasoni*, by Miss Mahon, daughter of T. C. Mahon, Esq., of London. She is to be commanded by Captain C. M. Burchell, of Cape Breton, Canada, under whose superintendence she has been built. The *Eskasoni* is registered at Windsor, Nova Scotia, and we believe is the first iron ship registered at that port. This ship is No. 320 in the Builder's books, and we have every confidence that she will do credit to both builders and owners.

Hubbuck.—On January 20th Messrs. Joseph L. Thompson and Sons, launched from their shipbuilding yard North Sands, Sunderland, the steel steamer *Hubbuck*, built to the order of Messrs. H. Lund & Partners, of London, for the Australian Wool and Passenger service. The vessel is of the following dimensions, viz.:—Length, 338 ft.; breadth, 40 ft.; depth of hold, 25 ft. 6 in.; with a total displacement of about 6,000 tons; having double bottom fore and aft for water ballast, on the longitudinal cellulae system. The vessel is built on the three-deck rules, and is of the highest classification at Lloyd's. The engines which are of 1,800 I.H.P., are being built by Messrs. T. Richardson and Sons, of Hartlepool, and are of the triple expansion type, designed to develop power for a speed of eleven knots, with very economical consumption, constructed under the superintendence of Mr. A. Thomson, of the firm of Thomson & Port, of London. The launch was witnessed by a number of friends of the owners, including Mr. & Mrs. Hubbuck, Mr., Mrs. & Miss Lund, of London. The ceremony of naming the vessel was performed by Mrs. Hubbuck, who gave the name to the vessel on leaving the stocks. During the construction the vessel has been under the supervision of Captain Mackenzie, on behalf of the owners.

Dalmazia.—On January 21st there was launched from the yard of Messrs. John Knox & Co., Limited, South Hylton, Southwick, Sunderland, an iron screw-steamer of the following dimensions:—Length, 131 ft.; breadth, 21 ft.; and depth, 11 ft. She is built to class 100 A1 at Lloyd's, and First Division Veritas under special survey. The vessel is intended for the passenger and general cargo trade in the Adriatic, and is fitted with a half-poop, quarter-deck, bridge, and sunkforecastle. The accommodation for the passengers is in the poop. Under the bridge is the quarters for captain and engineers, and the crew are berthed under the forecastle. The vessel has every facility for the working of the cargo and ground tackle, having two steam winches, donkey boiler, and one of Emerson and Walker's patent windlasses, which is arranged to be driven by steam or worked by hand as desired. There are tanks fore and aft to contain about 80 tons in water ballast. The engines, which are of the compound surface condensing type, are made by Mr. George Clark, of the Southwick Engine Works, and are of 200 H.P. The vessel, which has been built to the order of M. Sverljuga and Co., Fiume, Austro-Hungary, a new firm, will be commanded by Captain Sterk, who has been superintending the building of the vessel. The ceremony of christening was performed by Miss Victoria Brosinvich, daughter of Mr. V. Brosinvich, agent to Messrs. Sverljuga & Co., being christened the *Dalmazia*.

LAUNCHES—Scotch.

President Meyer.—On December 23rd there was launched from the yard of the Fairfield Shipbuilding and Engineering Co., Limited, a steel screw steamer of about 5,500 tons gross register for the Norddeutscher Lloyd Co. of Bremen. This vessel, which is intended for the Company's Bremen and New York line, is of the following dimensions:—Length, 455 ft.; breadth, 48 ft.; depth moulded, 36 ft. 3 in. She will be classed in the highest grade of the Bureau Veritas, the scantlings being in excess of their requirements. The upper and main decks are of teak, and all deckhouses, &c., are of steel and teak. To protect the vessel from the heavy Atlantic seas, strongly constructed turtle-backs are placed at both ends of the ship. When completed the vessel will have accommodation for 224 first-class, 94 second-class, and 850 third-class passengers, besides ample accommodation for ship's officers and crew, 170 in number. Special attention has been paid to the ventilation. The outfit for the ship is complete with all the latest improvements, having steam windlass, steam and hand capstans, steam and hand steering gear, steam hold pumps, steam Downton pumps for fire and wash-deck purposes, fresh water condensers, steel lifeboats—in fact, all that will ensure the safety of ship at sea, working of cargo, and comfort of passengers. The vessel is to be rigged with four pole masts of steel, with yards on the foremasts. She will be fitted with a set of triple expansion engines. The engines have three inverted cylinders and three cranks. The high-pressure cylinder is 44 inches, the intermediate 70 inches, and the low pressure 108 inches diameter, and each is adapted for a stroke of six feet. All the cylinders are fitted with equilibrium piston valves, which are placed behind the cylinder and worked by the Bryce-Douglas patent valve gear. This arrangement of gear for working the valves dispenses with the use of the usual double eccentrics and link motion. The crank shaft is built, is in three parts, each part being interchangeable with the other. The crank shaft, tunnel and propeller shafts, are all made of Messrs. Vickers, Sons & Co.'s steel. There are two air pumps, one worked off the crosshead of the high-pressure cylinder, and the other off the crosshead of the low-pressure cylinder. The feed and bilge pumps are separate, and driven by an independent triple expansion engine. The water for condensing the steam is circulated through the tubes of the condenser by two centrifugal pumps, each pump worked by a separate compound engine, and each is capable of discharging about 1,600 tons of water per hour, and they can be used for pumping water out of the ship if required in case of accident. The propeller has four blades of manganese bronze. The boilers for supplying steam to the engines are six in number, they are multitubular, and fired from both ends; each has six of Fox's corrugated furnaces, making a total of 36 furnaces. The boilers are constructed entirely of steel, and are adapted for a working pressure of 150 lbs. per square inch. The machinery for this vessel is similar to that lately fitted to the *Parthia* by this firm. The vessel was named the *President Meyer* by Mrs. Barre.

British Prince.—On December 23rd Messrs. Marr Brothers, Leith, launched the *British Prince*, a steam fishing boat of 46 tons register, which has been built to the order of Mr. W. H. Storey, North Shields. She is to be engaged in the line fishing.

Steam Yacht.—On December 24th the Culzean Shipbuilding and Engineering Company, Limited, whose works are on the South Ayrshire coast, launched on the following day a steel and iron steam yacht of 90 tons, with engines of 30 N.H.P. She has been built to the order of Mr. Andrew Thomson, London.

Ilma.—On December 25th the Grangemouth Dockyard Company launched the *Ilma*, a handsomely-modelled steel barquentine. She measures 140 ft. by 27 ft. by 12 ft., and is intended to trade on the South American coast. She will sail under the Norwegian flag, and has been built to the order of Messrs. Foster, Alcock and Co., London.

Amherst.—On January 6th Messrs. Blackwood & Gordon launched from their shipbuilding yard at Port Glasgow, an iron screw steamer of the following dimensions:—Length of keel and forerake, 130 ft.; breadth of beam, 25 ft.; depth of hold, 10 ft. tonnage, gross, 250 tons. This vessel has been built to the order of Messrs. Bow, M'Lachlan & Co., Paisley, for clients abroad, and is to be employed in general trade in the East. On leaving the ways she was named the *Amherst*, by Mrs. M'Lachlan, wife of one of the owners. She is to be fitted by Messrs. Bow, M'Lachlan and Co., with her engines and boilers, and when completed it is expected she will attain a good rate of speed. The vessel has been built under Lloyd's special survey to their highest class.

Ventura.—On January 6th Messrs. A. M'Millan & Son launched from their dockyard, Dumbarton, the steel ship *Ventura*, of 1,710 tons gross register, and of the following dimensions, viz.:—Length, 260 ft.; breadth, 30 ft.; depth, 23 ft. The new ship is constructed of Siemens-Martin steel, the principal spars and standing rigging being of the same material. The vessel has been built to the order of the Scotia Shipping Company, Glasgow,

and she is to be engaged in the East Indian, Australian, and San Franciscan trades.

Loch Etive.—On January 21st there was launched at Dundee, by Messrs. Gourlay Bros. & Co., a steel steamer named the *Loch Etive*, for the Loch Line Steam Shipping Company, Dundee. Her dimensions are:—Length, 294 ft.; breadth, 37 ft.; and depth of hold, 26 ft. 3 in. Gross tonnage, 2,148. She is flush decked, and has five watertight bulkheads, and will be fitted up with all the most modern appliances, including triple expansion engines of 220 N.H.P., 1,150 I.H.P. She is intended for the Eastern trade, and her command has been entrusted to Captain Stewart Lee, the commodore captain of the company.

Monmouthshire.—On January 21st the London and Glasgow Engineering and Iron Shipbuilding Company (Limited), Glasgow, launched from their yard, at Govan, a steel screw-steamer of about 2,950 tons gross register, built for Messrs. Jenkins & Co., of London, for their Eastern trade. The steamer was named the *Monmouthshire* on leaving the ways by Mrs. Hudson, and is of the following dimensions:—Length between perpendiculars, 344 ft.; breadth of beam, 40 ft.; depth, 26 ft. 6 in. She is built to the highest class in Lloyd's register, 100 A1, three-decked, and will have accommodation for 25 first-class passengers in saloon on main-deck aft. The fittings are of a most elegant and complete description, suitable to the trade for which she is specially designed. The steam windlass is by Napier Brothers, of Glasgow, and the steam steering gear by Muir and Caldwell, of Glasgow. Great attention has been given to the ventilating and sanitary arrangements throughout the vessel, all being of the most modern and complete description. The vessel will be fitted by her builders with engines of the triple expansion type, in the designing of which all the latest improvements have been adopted, and it is expected a high rate of speed will be attained.

IRISH.

Iran.—On January 6th there was launched from the shipbuilding yard of Messrs. Harland and Wolff, Belfast, a steamer, 380 ft. long, 42 ft. 6 in. broad, and 31 ft. ½ in. deep, capable of carrying about 5,000 tons, and built for Messrs. E. Bates and Sons, of Liverpool. She is named *Iran*, and is intended principally for the Eastern trade, but has been so designed and constructed that she may be profitably engaged in the American or other trade if required.

FRENCH.

Gascoyne.—The *Gascoyne*, which has lately been launched at La Seyne, near Toulon, will be the largest vessel in the French merchant navy, as she will be 480 ft. long by 52 ft. broad, being built chiefly of Canadian elm and teak. The masts, &c., are in steel instead of wood, and she has four decks, the upper one being so built as to carry when required seven 6-inch guns. The *Gascoyne*, large as she is, has only one screw, but it is of immense size, weighing nearly 26 tons, and there are 6,000 cubic feet of space for coal. All the metallic part of the hull is in steel, and she carries 22 boats, of which ten are built as lifeboats, with automatic fastenings and all necessary appliances for navigating them should the vessel be lost. There is accommodation for 221 first and 92 second class passengers, and several of the cabins have regular beds, single and double. The general sitting-room opens on to the dining-room, and there is a very spacious ladies'-room, all of which are to be very sumptuously decorated and furnished. The whole of the vessel is to be lighted with electricity and heated with steam, while the reservoirs hold 30,000 gallons of fresh water, and there is a distilling apparatus which will provide about 1,500 gallons a day. The total cost of this vessel to the Transatlantic Company will be about £320,000, or treble that of the largest vessel belonging to the French Messageries. Like her sister ship the *Bourgoyne*, launched last October, she was built under the superintendence of the Bureau Veritas, and will receive the highest mark which this register accords, with the special notification that she fulfils certain conditions as to build watertight compartments, &c. Her engines will be of 15,000 H.P. when in full motion.

AUSTRIAN.

Poseidon.—On September 9th this screw-steamer was launched from the Austro-Hungarian Lloyd's shipbuilding yard, in Trieste, and was taken on her trial trip on January 19th. This steamer is built of steel to class 100 A1 at Lloyd's, of the following dimensions:—Length, 386 ft.; breadth, 42 ft. 6 in.; depth moulded, 26 ft. 3 in.; height to spar-deck, 7 ft. 9 in.; displacement, 6,611 tons. The engines are of the inverted cylinder, direct-acting compound type, and can work up to 3,300 H.P., with an I.H.P. of 2,800. She attained a speed of 14¾ knots at the measured mile. Cylinders 50 and 90 in. in diameter, and 57 in. stroke, two double-ended steel boilers with 12 furnaces, and a working pressure of 90 lbs. per square inch. The electric light plant consists of 129 incandescents, the dynamo is supplied by Kremecky, Mayer & Co., of Vienna, and the engine by Siegel & Co., of the same city. The electric light at the masthead is driven by L. Sautter, Lemonnier & Co.'s engine of Paris. She is fitted with S. Baxter's patent anchors and seating, and with Lightfoot's patent refrigerator, Donking and Nichols' patent steering gear, and four large steam winches. She has accommodation for 54 first-class passengers on the main-deck, the dining-room is 28 ft. long, and extending to the full breadth of the vessel on the spar-deck, music saloon 32 ft. by 17 ft., and above that smoking and entrance saloon from promenade deck 20 ft. by 11 ft., the saloon and state rooms are fitted up in a handsome and costly style, and with every comfort. There is also accommodation for 38 second class passengers, who have a very commodious dining saloon, and above that, on deck smoking and card saloon 22 ft. by 17 ft., she also carries 400 steerage passengers. Officers and Engineers' cabins are fitted on deck amidships, and accommodation for petty officers and crew under forecastle. She is rigged as a three-masted schooner.

TRIAL TRIPS.

Falke.—On December 24th the *Falke*, torpedo-boat, built by Messrs. Yarrow for the Austrian government, made her official trial, at which the mean speed of her six runs over the measured mile, made in fighting trim, reached the surprising figure of 22·263 knots per hour, the vessel having actually covered 22¼ knots within the hour. The *Falke* is 135 ft. long, 14 ft. in extreme width, and 9 ft. deep. Her draught forward in fighting trim is 2 ft. 3 in. and aft 5 ft. 6 in., her displacement being 88 tons. She is built throughout of galvanised steel, her skin varying in thickness from one-eighth to one-quarter of an inch, the greatest thickness being at her bows, to strengthen her for ramming purposes. Her machinery is of the compound surface-condensing type, having three cylinders. One of the most important peculiarities of the boat is that she is fitted with a locomotive boiler which generates steam sufficient to indicate 1,400 H.P. The trial of this boiler has been looked forward to with great interest, as in the event of its proving successful it will create a complete revolution in the construction of boilers for marine engines where forced draught is necessary. It did its work on the day of the trial in a most satisfactory manner, furnishing an abundance of steam with a minimum of trouble. It is fitted with a copper fire-box and brass tubes, and it has withstood without leaking the bearing strain of eight full-speed trials. The boiler has more than 2,000 feet of heating surface, and there is a grate surface of 44 square feet. The torpedo arrangements consist of two bow-tubes adapted for discharging the Whitehead torpedo in a direction parallel with the keel, as is usual in the Austrian service. No spare torpedoes will be carried, inasmuch as the Austrian authorities attach primary importance to the maintenance of the highest possible speed, and therefore object to their boats being weighted with a number of torpedoes, which would necessarily greatly reduce their speed. The vessel, however, will carry two Nordenfelt machine-guns, one on each side. The boiler and machinery are partly protected from shot by the coal bunkers, which run longitudinally right through the engine and boiler-room on each side, and transversely in front of the boiler, so that when these bunkers are full a certain amount of shot protection will be secured. The accommodation for the officers is provided in a cabin forward, the crew being berthed aft. In this respect the practice of the Austrian service differs from that of all other nations, which invariably berth their officers aft, where the noise and vibration of the screw are the greatest. The propeller, which is a two-bladed one, is forged out of a single block of steel. The vessel is steered by means of two rudders, one placed at the bow and the other at the stern, which can be worked either by steam or hand gear. One important point with regard to the navigation of the boat is that the officer in charge, instead of being stationed forward, as is usually the case in these boats, will occupy a steering tower secured to the top of the deck amidships, and

thus he will be placed in an elevated position, from which he will have an all-round view and can better direct the movements of his vessel, while he will be removed to a sufficient distance from the rush of water and spray which in most of these exceedingly fast boats, tearing through rough water, greatly obstructs the view of the steersman. In midship section the boat is almost cylindrical, the deck being considerably rounded, a mode of construction which her designers believe will give greater strength with better sea-going qualities for a given weight. All openings in the side and in the deck can be closed so as altogether to exclude water, and therefore it is anticipated that she will prove herself to be safe in a considerable seaway. To meet, however, the contingency of water finding an entrance into the boiler room, precautions have been taken to prevent the fires been extinguished, the air, instead of being brought directly to the stokehole, having to pass first over a bulkhead considerably above the water line, and thus, even should the stokehole become filled with water, the steaming powers of the boat will not be diminished. The *Falke* left Messrs. Yarrow's wharf at half past eleven o'clock, and proceeded down the river at half-speed until she reached Gravesend, when the six runs at full speed were made on the measured mile at the Lower Hope. The water was smooth, and there was scarcely any wind, the trial being made under very favourable circumstances. The rates of speed attained by the vessel in her six runs were:—First mile, 23·076 knots an hour; second mile, 21·428 knots an hour; third mile, 23·529 knots an hour; fourth mile, 21·428 knots an hour; fifth mile, 22·360 knots an hour; and sixth mile, 21·959 knots an hour, giving a mean for the whole of 22·263 knots an hour, being, it is claimed, the fastest time that has ever been made by a steamship. In accordance with the terms of the contract with the Austrian Government, the vessel then made an hour's run at full speed, in the course of which she made a total distance of 22¼ miles. During her full-speed trials the pressure of steam in the boiler was 143 lb. per square inch, the revolutions of the engines being 360 per minute. The vessel steered with great facility throughout, and when at full speed the vibration was exceptionally small. Messrs. Yarrow, who employ 1,200 men, are now building twenty-four torpedo-boats for the English Government, of 125 feet long; three for the Portuguese Government; one for the Japanese Government, which is remarkable as being partly armour-plated, the machinery being surrounded by inch plates, and as being propelled by twin screws; one for the Dutch Government; one for the Chilian Government; two for the Italian Government; one for the Spanish Government, and another for the Austrian Government.

Irrawaddy.—On December 28th the new trawling smack *Irrawaddy* left the Albert Dock, Hull, for a trial trip. The day proved a most favourable one for testing the sea-going qualities of both ship and engines. The performance of the vessel and engines was in every way satisfactory. Upon arriving at Grimsby, an attempt was made to adjust the compasses, but this had to be abandoned owing to the heavy motion of the vessel. She was then got fairly under way, and steamed out of the Humber and along the coast to Withernsea, there being put upon the measured mile. This was steamed over in 5 min. 26 sec., the tide being just at low water, thus giving a speed of fully 11 knots per hour. During the performance a blinding squall was blowing, stopping the way of the vessel considerably. The vessel has been built by Messrs. Cook, Welton, & Gemmell, for Mr. George Beeching, smackowner, Hull, to the order of Messrs. Charles D. Holmes & Co., who have supplied the engines, boiler, and trawling machinery.

Knight of St. Patrick.—On December 30th the trial trip of this new twin-screw tug steamer, recently launched from the yard of the Grangemouth Dockyard Company, took place on the Firth of Forth. This vessel has been built to the order of Messrs. Dunsmuir & Jackson, engineers, Govan, for Messrs. J. Prendiville and Co., Liverpool. She is built entirely of Siemens steel, and is divided into ten water-tight compartments, a special feature being that all the coal bunkers are water-tight, fitted with sliding doors. Ballast tanks are fitted forward and aft. Her dimensions are 146 ft. by 23 ft. 7 in. by 13 ft. She is propelled by two pairs of compound surface-condensing engines, made by Messrs. Dunsmuir & Jackson. The boilers, which are of steel, are of much larger size than usual, and are loaded to a pressure of 110 lb. Although the day was not fine, the trial was in every way satisfactory. A speed of 15 knots per hour was attained, over two knots more than the guaranteed speed.

Bellerophon.—On December 31st the *Bellerophon*, 28, armour-plated ship, which has been commissioned as flagship of the North America and West India station, was taken outside Plymouth breakwater, for a preliminary trial of her machinery. She has undergone extensive repairs, and everything on board is of the latest and newest design except the main engines, which are not compounded. If this were done the speed of the ship would be improved. The vessel is a perfect box of machinery, having no fewer than seventeen engines on board. The *Bellerophon* is the most formidable broadside ship afloat. She was first fitted with ten 8 in., four 6 in., and six 5 in. breech-loading guns, all on Vavasseur mountings. In addition, she has sixteen machine guns, four quick-firing guns, and twelve Whitehead torpedoes. The *Bellerophon* now carries in the main battery ten 8 in. 13 ton breech-loading guns, mounted on Vavasseur carriages; on the main deck aft two 6 in. 89 cwt. breech-loading guns, and under the forecastle the same number; on the upper deck six 4 in. 22½ cwt. breech-loading guns; on the upper works four 6-pounders (Hotchkiss's), eight 1 in. Nordenfelts, two 45 Nordenfelts, and two ·45 Gardners. She also carries twelve 14 in. Whitehead torpedoes, with two electric search lights. The preliminary trial of the machinery was considered highly satisfactory. After this gun trials were gone through. The Vavasseur mountings withstood the test very well, and also the deck fittings and deck. The last named was deflected one-eight of an inch when a broadside of 500 lb. of powder and 1,050 lb. of shell was discharged. The gun trials were considered satisfactory. The ship then returned to the Sound, where torpedoes were fired for the purpose of testing the efficiency of their fitments, compressed air apparatus, &c.

Duchess.—On January 2nd the paddle steamer *Duchess*, built by Messrs. Lawson & Eltringham, of South Shields, and engined by Messrs. R. B. Findlay & Sons, of the Bell-street Engine Works, North Shields, to the order of Mr. J. T. Davison, of North Shields, ran a successful trial trip. The vessel, which is intended principally for fishing purposes, is fitted with steel boilers and floats, and is classed 100 A at Lloyd's, with machinery certificate, and built under Lloyd's surveyor's inspection. Her engines are on a 35 in. principle, and run 44 H.P. on a 4 ft. 4 in. stroke. The run gave every satisfaction to all concerned; the *Duchess* making 11 knots an hour over a given distance between Shields and Blyth.

Medusa.—On January 7th the new steamer *Medusa*, recently built for Mr. Alfred Holt by W. H. Potter & Sons, Liverpool, was taken out for trial of her engines, which were made by Messrs. Fawcett, Preston, & Co., and are of the surface condensing type, capable of indicating 500 H.P. in ordinary working. The dimensions of the cylinders are:—High pressure, 20 in. diameter; low pressure, 46 in. diameter, by 3 ft. stroke; one single-ended boiler, with a working pressure of 80 lbs., and a total heating surface of 2,120 square feet. The engines are duplicates of those made by Messrs. Fawcett, Preston, & Co., for the steamship *Hecate*, which was built for the same owner last year by Messrs. W. H. Potter & Sons. The trial trip is reported to have been in every way successful, the mean speed on the measured mile being over 10½ knots. The engines ran 80 revolutions per minute, with a vacuum of 28 in., everything working well and to the entire satisfaction of Mr. Wiles, the superintending engineer to Mr. A. Holt, the owner.

Curlew.—On January 14th the *Curlew* (s), built for the English Channel trade, by the Campbeltown Shipbuilding Company, had a successful trial trip, when a speed of 10 knots was obtained. The *Curlew* is a vessel of 400 tons deadweight, built to the highest class of Lloyd's, under special survey, has a Hastie's patent steam-steering gear, and is otherwise fitted up in the most approved manner for economy in working. Her tonnage is 112 tons nett and 312 tons gross. The engines were made by Messrs. Walker, Henderson & Co., of Glasgow, and are triple expansion.

Adler.—On January 14th the official trial took place of the torpedo boat *Adler*, which Messrs. Yarrow & Co. have completed for the Austrian Government, and the speed obtained was 22·4 knots loaded with 16·9 tons, representing the fully equipped condition. The *Adler* is the fastest torpedo boat at present afloat, and will shortly leave this country for Pola. Her dimensions are 135 ft. in length by 14 ft. beam. The officers' accommodation in this case is forward of the machinery, and the crew are placed aft, which is the usual practice in the Austrian service. There will be two torpedo guns fitted forward for dire t ahead fire. The coal capacity is equivalent to a run, at a speed of 11 knots, of from 2,000 to 2,500 miles.

Prometheus.—On January 15th the s.s. *Prometheus*, built by Messrs. R. & W. Hawthorn, Leslie & Co., to the order of the Ocean Steamship Company of Liverpool, left the Tyne. The dimensions of the vessel are as follows:—Length, 320 ft.; breadth, 36 ft.; and depth, 27 ft. 9 in. Her engines, constructed by

Messrs. Robert Stephenson & Co., are of the Holt's tandem design, having cylinders 27 in. and 58 in. diameter, with a stroke of 5 ft., and indicating 1,500 H.P. Steam of 80 lb. pressure is supplied from one large double-ended steel boiler of a total weight of 75 tons, and this is fitted with Fox's patent corrugated furnaces. After the compasses were adjusted the engines were put under full steam, and a speed of 12¼ knots was attained. This is the second of four similar vessels now being built and engined by the same firms.

Calliope.—On January 19th this unarmoured corvette tried her complement of 5-inch broadside and 6-inch sponson breech-loaders at Spithead. Three rounds were fired from each gun with scaling, half, and full charges without any hitch occurring. She also made a trial of her torpedo gear with complete success. Before returning into harbour she was run for a preliminary full-power trial of her engines under forced draught, for which she has been fitted by the dockyard engineers; 3,750 horses were developed, which is greatly in excess of the power obtained from the *Calypso*, which is the only other ship of the class that can be worked with closed stokeholds.

Lindsey.—On January 19th the steam fishing cutter *Lindsey*, built and engined by Messrs. Earle's Shipbuilding and Engineering Company, Limited, Hull, for the Boston Deep Sea Fishing Company, Limited, was taken on her trial trip. The following are the particulars of the vessel:—Length, pp., 100 feet; breadth, extreme, 20 feet, and depth of hold to top of floors, 10 ft. 6 in. She has a raised quarter-deck aft, bridge amidships, and forecastle, iron casings over engines and boiler, with galley at fore end, is dandy-rigged, with two pole masts, and has accommodation for captain, mates and engineers, in cabin aft, and for crew in forecastle. The vessel is fitted with patent windlass, worked by messenger chain from a 6 in. by 10 in. steam winch of Earle's special make and design. She is propelled by a set of compound engines on the triple expansion system, also made and fitted by Messrs. Earle, and having cylinders 11½in., 17 in. and 30 in. diameter by 21 in. stroke, and supplied with steam from a steel boiler, made for a working pressure of 150 lbs. to the square inch. Owing to the extremely foggy weather the vessel could not be taken on the measured mile off Withernsea, but the engines worked most smoothly and satisfactorily.

Chelydra.—The steel steamer *Chelydra*, built by the firm of Messrs. Jos. L. Thompson & Sons, of Sunderland, recently had a series of progressive speed trials taken off the Northumberland coast. This vessel has been built to the order of Messrs. Angier Bros., of London, for their China service; she is a vessel of the following dimensions, viz.:—Length, 312 ft.: breadth, 40 ft.; depth of hold, 25 ft.; built on the three deck rules for the highest classification at Lloyd's, having a double bottom fore and aft on the cellular system, and is considerably strengthened above Lloyd's requirements for steel vessels. The *Chelydra* has accommodation for a number of first-class passengers, having Board of Trade certificate, and is designed for emigrants and transport service. The whole of the decks are of teak, and her saloons, officers, and engineers' berths and crew accommodation, are specially arranged for the China trades, and lighted throughout with an electric installation by Messrs. Clarke, Chapman, Parsons and Co., of Gateshead. The engines were built by Messrs. Thomas Richardson & Sons, of Hartlepool, and are of the triple expansion type, having three cranks and designed to indicate 1,400 H.P. The vessel having been placed on the measured mile off Whitby, the following results were obtained, viz.:—With 74 revolutions per minute, 12·12 knots per hour; with 64 revolutions per minute, 10 knots, the lowest speed being 8·67 knots, with 52 revolutions per minute. These trials enable the builder to supply speed and power curves, the vessel previous to leaving their works being heeled under light, and load twice, from which the stability curves are calculated, and a form is supplied to the owners showing the angles of inclination of the vessels under ballast trim and loaded with homogeneous and other cargoes. The *Chelydra* is one of three vessels building for Messrs. Angier Bros. for their China service.

A Victorian Hopper Barge.—The Victorian Public Works Department has resolved to have an iron twin-screw hopper barge built in Victoria, for harbour purposes at Geelong. It will take up 500 tons per hour, steam six miles per hour with 1,200 tons, and will cost £47,700. The hopper will be built by Messrs. Foreman & Co., of Yarra Bank.

LIST OF SHIPS BUILT DURING 1884–1885, OR NOW BUILDING, AT THE ROUEN SHIPBUILDING YARD (PETIT QUEVILLY).

(Société Anonyme des Anciens Etablissements, Claparède.)

Names.	Displacement when laden.	Gross Tonnage for Customs.	Class of Ship and Owners.	Length.	Breadth.	H.P.	Rig and Surface of Sails.
	T.	T.		M.	M.		Sq. M.
Ville-de-Bastia ..	1066·432	829·63	Screw Mail Packet (of Steel) for subsidised Postal Service to Corsica	68·733	8·500	1100	Schooner 330
Two Barges ..	150·000	—	For the Cie. Générals Transatlantique	20·000	4·300	—	— —
Victoire	145·284	103·34	Screw Tug for Saigon (Hersent Entreprise)	26·500	5·000	220	Schooner 110
Courbet	183·185	178·68	Screw Steamer for Cargo and Passengers (of steel), for the Colonial Entreprises Co. of Haiphing (Tonquin)	38·000	7·400	300	— —
Sainte-Barbe ..	321·007	—	Torpedo Despatch Boat, for National Navy	61·300	6·740	2000	Three Mast Schooner, 240
Salve	321·007	—	Do. do.	61·300	6·740	2000	Do. 240
Bouet-Willaumez	66·320	—	Torpedo Coast Guard do.	40·750	3·330	700	Do.
Dehoter	66·320	—	Do. do.	40·750	3·330	700	Do.
Edmond Fontaine	66·320	—	Do. do.	40·750	3·330	700	Do.
Ga-Bac	165·190	—	Tank Boat for Tonquin do.	29·000	6·000	120	Schooner 110
Gia	165·190	—	Do. do.	29,000	6·000	120	Do. 110
Hâleur	356·700	—	Screw Tug (Brest) do.	36,100	8·000	900	One Mast only.
Pontoon-Shears ..	400·000	—	Pontoon with 40-ton Shears for the Cie. Générale Transatlantique ..	25,000	11·000	80	— —
Drîme	2200·000	—	Screw Transport (in steel), for National Navy	72,000	9·640	1200	Three Masts .. 900

N.B.—The Drîme is now building, the order only having just been placed.

LIST OF VESSELS LAUNCHED ON THE CONTINENT IN 1885.

GERMAN.

By George Howaldt, Kiel.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Kiel..	Iron	Steam	German	1,103	450
Telegraph	Steel	,,	,,	49	50
Niolot	,,	,,	,,	49	60
Stadt Stralsund ..	Iron	,,	,,	172	120
Carge	,,	—	,,	90	—
Carl Marie von Weber	Steel	Steam	,,	36	30
Cranz	,,	,,	,,	142	250
14 dredger Barges..	,,	—	,,	794	—
Nordfriesland ..	,,	Steam	,,	54	60
Westerland ..	,,	,,	,,	83	60
Hedwig	,,	Sail	,,	332	—
Mars	Iron	Steam	Dutch	Abt 490	300

By Schiff-und Maschinenbau-Actien-Gesellschaft, Kiel.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Luna	Iron	Sail	German	848	—
Brake	,,	Steam	,,	519	320
Anna	,,	Sail	,,	1,139	—
Nachtigal	Composite	Steam	G. Navy	225	220
Moewe	Iron	Sail	German	1,097	—
Orion (Torpedo boat)	Steel	Steam	Sp. Nav	83	1,000

By Flensburger Schiffsbau-Gesellschaft, Flensburg.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Octa	Iron	Steam	Danish	354	200
Sirius	S. and I.	,,	Norwgn.	860	700
Rota	Iron	,,	German	1C0	170
Ernst Gunther ..	,,	,,	,,	132	280
Kilwa	,,	,,	,,	329	220
Barawa	,,	,,	,,	329	220
Wega	,,	,,	,,	822	460

By H. F. Ulrichs, Vegisack, Germany.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Ursula..	Iron	Sail	Foreign	1,550	—
Lesum..	,,	Steam	,,	55	60
Fortuna	,,	,,	,,	165	100

By Reiherstieg Schiffswerfte und Maschinenfabrik, Hamburg

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Stockholm	Iron	Steam	German	667	460
Siloia	,,	,,	,,	893	460

By Blohm & Voss, Hamburg.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Destorro	Iron	Steam	German	2,011	1,000
Freia	Steel	,,	,,	683	1,600
Paposo	Iron	Sail	,,	1,062	—
Plus	,,	,,	,,	1,259	—

By F. Schlichau, Elbing.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Muthwillig	Steel	Steam	Russian	—	130
Kourier	,,	,,	,,	—	115
Kourier	,,	,,	,,	—	130
Mazur..	,,	,,	,,	—	150
Grossherrog Frederich-Franz	,,	,,	German	—	800
Wetka..	,,	,,	Russian	—	150
Elbing..	,,	,,	German	—	110
22 Torpedo boats ..	,,	,,	,,	—	900
Falke	,,	,,	Russian	—	70
9 Dredging boats ..	,,	,,	German	—	—
Königsberg	,,	,,	,,	—	630
9 Torpedo boats ..	,,	,,	Chinese	—	450
Floating dock ..	Wood	,,	German	—	—
Paddle steamer ..	Steel	,,	Russian	—	160
Paddle steamer ..	,,	,,	,,	—	160
Torpedo boat.. ..	,,	,,	Chinese	—	1,400
Morgenröthe.. ..	,,	,,	Russian	—	110
3 Torpedo boats ..	,,	,,	,,	—	900
Paddle steamer ..	,,	,,	,,	—	160

By Rostocker Actiengesellschaft fur Schiff & Maschinenbau, Rostock.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
T. C. Julius	Iron	Sail	Hmburg	1,120	—
Lilla	,,	,,	,,	1,120	—
No. 85	,,	Steam	Rostock	90	100
No. 86	,,	Sail	Hmburg	1,480	—

The Lilla, No. 85, and No. 86 are now building, and will be launched in a few months.

FRENCH.

By La Cie. des Messageries Maritimes, La Ciotat.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Hai Phong	Steel	Steam	M.Marit.	1,493	1,400

By the Penhoet Ship Yard and Engineering Works, St. Nazaire.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
La Champagne ..	Steel	Steam	Transatl	—	8,000
La Bretagne	,,	,,	,,	—	8,000

Sister Ships.—Length, 150 metres; Breadth, 15·70 metres; Depth, 11·70 metres.
N.B.—This is the Transatlantic Cies'. own yard.

BELGIUM.

By John Cockerill, Seraing, Hoboken, near Antwerp.

Name of Vessel.	Built of	Class.	Owners.	G. T. Reg.	H.P. I.
P. Albert de Belgique	Steel	Steam	Belgian	1,736	750
*Princess Josephine ..	,,	,,	,,	1,736	750
Ville d'Anvers Aviso..	,,	,,	,,	950	800
Batoum (Dredger) ..	,,	,,	Russian	250	110
Renonquein (Tug) ..	,,	,,	,,	40	40
Hopper barge	Iron	,,	,,	300	—
Hopper barge	,,	,,	,,	300	—

* Sister to P. Albert.

RUSSIAN.

Baltic Works, St. Petersburg.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Admiral Nakimoff ..	Steel	Steam	R. Govt.	7,800	8,000
Torpedo boat.. ..	,,	,,	,,	67	500

AUSTRIAN.

Messrs. The Stabilimento Tecnico, Trieste.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
L'Adriatico	Iron	Steam	Argent.	124	45
Ambrosios	,,	,,	Russian	324	50
Rialto	,,	,,	Italian	81	25
Ika	,,	,,	Austrian	110	30
Patagonia	Steel	,,	Argent.	1,500	2,400 I
Pycь	,,	,,	Russian	437	90 N

DUTCH.

By P. Smit, Jr., Scheepsbouwmeester, Slikkerveer, near Rotterdam.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Government's pilot-bt.	Wood	Sail	Holland	—	—
,,	,,	,,	,,	—	—
Suriname	Steel	Steam	Surinme.	—	25
Johan II.	Iron	,,	Holland	—	100
Figaro	,,	,,	,,	—	125
Goudvink	,,	,,	,,	—	125
U. V. W.	,,	,,	,,	—	125
Satae	,,	S. & S.	,,	—	200
Partout	,,	Steam	,,	—	125

By Koninklijke Fabriek Van Stoom en Andere, Werktuigen, Amsterdam.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Condor	Composite	Steam	Dutch	111	325
Rynbeurtvaart I ..	Iron	Sail	,,	260	—
,, III ..	,,	,,	,,	,,	—
,, V ..	,,	,,	,,	,,	—
,, VII ..	,,	,,	,,	,,	—

By the Nederlandsche Stoomboot Maatschappy, Rotterdam.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Unknown	Iron	Sail	German	537	—
Amstelstroam ..	,,	Steam	Dutch	843	600
Mathias Stinnes V ..	,,	,,	German	400	750
Tava	,,	,,	Foreign	500	1,100

FINLAND.

By W. Crichton & Co., Abo, Finland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Michael	Steel	—	Russian	—	275
Onni	,,	—	Finnish	—	175
Falken..	,,	—	,,	—	65
Bobr	,,	—	Russian	—	1,200
Torpedo Launch ..	,,	—	,,	—	80
,,	,,	—	,,	—	80
,,	Wood	—	,,	—	80
,,	,,	—	,,	—	80

NORWAY.

By Messrs. Marten, Olsen & Co., Laxevaag, Bergen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Narrana	Iron & steel	Steam	Porsgd.	1,307	100
Capello	,,	,,	Bergen	887	130
Lanvikey	Iron	,,	,,	12	8
Geiranger	Iron & steel	,,	,,	157	30
Harden	Iron	,,	,,	25	15
Laxevaag	,,	,,	,,	25	12

SWEDISH.

By The Akers Mekaniska Werksled, Aktic Bolay, Christiania.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Hindo	Steel	Steam	Norweg.	79	154
Bastö	,,	,,	,,	92	154
Lofoten	Iron	,,	,,	350	300
Pasvig..	Steel	,,	,,	73	150
Stark	,,	,,	,,	27	60

By Kockums Mekaniska Werkstads Aktiebolag, Malmo.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Nissan..	Steel& Iron	Steam	Foreign	40	25
Lägg ut	Steel	,,	,,	*	30
Falsterbo	Steel&Iron	,,	,,	*	30
Ralkgrund	,,	,,	,,	*	—

* Not measured as belonging to Swedish Government.

DANISH.

By Messrs. Burmeisler & Wains, Copenhagen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Tomsk	Iron	Steam	Danish	1,690	180
Pröven	Iron&Steel	,,	,,	$46\frac{1}{4}$	25
A Steam Launch ..	Steel	,,	,,	—	4
M. G. Melchior ..	Iron&Steel	,,	,,	1,153	200

By Elsinore Iron Shipbuilding and Engineering Co., Elsinore, Denmark.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Orrik	Iron	Steam	Danish	409	249
Svanen	Steel	,,	,,	40	90
Nereur	,,	,,	,,	44	68
Jarl	,,	,,	,,	233	500

The Government have ordered a large number of Tyzack's patent anchors for delivery at short notice at one of the Royal Dockyards. This anchor has been extensively adopted on ships of the mercantile marine. At the recent trials ordered by the Lords of the Admiralty, at Portsmouth and Spithead, the action of Tyzack's anchor was found to be very steady, and it was the only one of the stockless anchors tested which did not roll over and come out of the ground with a heavy strain upon it. The greater the strain the more it buried itself. The anchor may be seen at the office of Mr. Charles Moore, 38, Gracechurch Street, London, E.C.

The keel of the largest ship yet built in Victoria was recently laid by the Commissioner of Customs. The builders are Messrs. Campbell, Anderson & Sloss. The vessel, which will cost £18,000, is for the Customs Department.

SHIPBUILDING ON THE NORTH-EAST COAST IN 1885.

IN addition to our remarks on this subject last month, we give a tabulated statement of the year's output, showing the tonnage produced in the separate ports and by individual builders, the tonnage in steam and sailing vessels, and also in iron and steel respectively.

We find the total tonnage for the Tyne to be the highest in the district, amounting to 106,083 tons, consisting of 93 vessels; of this 53,264 tons are iron vessels, and 51,568 tons steel, 975 tons combined iron and steel, and 276 tons wood.

The 975 tons combined iron and steel have been returned as hoppers, but are really sea-going steamers, and were built for the purpose of carrying slag from the Tees to Goole, where they deposit it for training walls by dropping it out of the sides through ports provided for the purpose. The tonnage is again divided into steam and sailing vessels, 102,508 tons and 3,575 tons respectively, the latter including barges.

Sunderland or more correctly the Wear, comes next with a total of 38 vessels, and a total tonnage of 45,068 tons, of which 36,631 tons are in iron, and 8,437 tons in steel, 16,381 tons sailing vessels, and 28,687 tons steamers.

The Hartlepools stand next with a total of 18 vessels aggregating 33,026 tons, and occupy the somewhat advanced position of having produced more tonnage in steel than iron, the former being represented by 18,691 tons, and the latter by 14,335 tons. Steamers and sailing vessels stand at 27,992 tons and 5,034 tons respectively. The Tees has turned out 34 vessels, including 14 barges, and amounting to 32,371 tons, 26,603 tons being iron, and 5,768 tons steel, 9,834 sailing vessels, and 22,537 steamers, this is exclusive of 22 fishing vessels of 78 tons built by Messrs. Dixon and Co., part of which are steamers.

The port of Blyth shows 2 steamers, both of iron and of 1,154 tons.

Thus we find the gross register tons to be 217,702 for the whole district, of which 38·8 per cent. is of steel.

The following table will show the work done by the various firms during the year, as well as that of 1884:—

TYNE.

Builders.	Reg. Tons.	Ships	Tons Iron.	Tons Steel.	Tons Steam.	Tons Sail.	Yr.
Palmer's Ship-	26055	17	10484	15571	20830	5225	'85
building Co.	28903	23	25503	3400	25791	3112	'84
A. Leslie & Co.	14834	6	12041	2793	14834	...	'85
	11214	8	9494	1720	11214	...	'84
Sir Wm. Arm-	14266	11	...	14266	14266	...	'85
strong & Co.	10741	11	10067	674	10135	606	'84
Swan &	12801	7	4080	8721	12801	...	'85
Hunter	5290	3	5290	...	5290	...	'84
John Readhead	12241	9	12241	...	12241	...	'85
& Co.	11072	8	11072	...	10844	228	'84
Wigham, Ric-	11388	9	6397	4991	11388	...	'85
hardson & Co.	10392	8	9881	511	10392	...	'84
Edwards & Sons	7226	15	3769	3487	4826	2400	'85
Campbell, Bow-	1252	2	1152	100	100	1152	'85
stead & Co.	6043	3	6043	...	4393	1650	'84
W. Dobson & Co.	975	2	I & S.	972	972	...	'85
Rennoldsons' ...	779	6	503	W.276	779	...	'85
Hepple & Co.	359	5	359	...	359	...	'85
	1139	10	943	S. 136 W. 60	1139	...	'84
T. & W. Smith	182	1	182	...	182	...	'85
	1805	2	1805	...	1805	...	'84
Scheslinger &	156½	2	156½	...	133½	23½	'85
Davis	4216	2	4216	...	4216	...	'84

BLYTH.

Builders.	Reg. Tons.	Ships	Tons Iron.	Tons Steel.	Tons Steam.	Tons Sail.	Yr.
Blyth Ship-	1154	2	1154	...	1154	...	'85
building Co.	5067	5	5067	...	5067	...	'84

WEAR.

Builders.	Reg. Tons.	Ships	Tons Iron.	Tons Steel.	Tons Steam.	Tons Sail.	Yr.
James Laing ...	11616	7	9236	2380	8907	2709	'85
	20805	11	20805	...	19538	1267	'84
Short, Bros. ...	11069	5	11069	...	11069	...	'85
	9600	5	9600	...	9600	...	'84
Doxford & Sons	6496	4	5193	1303	...	6496	'85
	19868	9	19868	...	16903	2965	'84
Osbourne,	2383	2	1492	891	891	1492	'85
Graham & Co	5378	4	5378	...	2650	2728	'84
Pickersgill &	2261	3	2261	...	148	2113	'85
Sons	6462	5	6462	...	4990	1472	'84
N. of England	1957	1	...	1957	1957	...	'85
Shipbldg. Co.	5179	3	5179	...	3894	1285	'84
Sunderland	1876	3	1876	...	1876	...	'85
Shipbldg. Co.	3242	4	3242	...	2789	453	'84
Boolds, Sharer	1730	3	750	980	1730	...	'85
& Co.	2710	4	2710	...	2710	...	'84
R. Thompson &	1632	2	1477	155	155	1477	'85
Sons	4903	4	4903	...	3909	994	'84
J. Priestman	845	1	845	...	845	...	'85
& Co.	3090	2	3090	...	3090	...	'84
J. Knox & Co.	320	2	320	...	320	...	'85

HARTLEPOOL.

Builders.	Reg. Tons.	Ships	Tons Iron.	Tons Steel.	Tons Steam.	Tons Sail.	Yr.
Wm. Gray and	20386	12	8579	11807	15352	5034	'85
Co.	17454	11	16228	1226	13350	4104	'84
Ed. Withy and	12640	6	5756	6884	12640	...	'85
Co.	10331	7	10331	...	10331	...	'84

TEES.

Builders.	Reg. Tons.	Ships	Tons Iron.	Tons Steel.	Tons Steam.	Tons Sail.	Yr.
Richardson	12799	20	12799	...	2965	9834	'85
Duck and Co.	15002	8	15002	...	7330	7672	'84
M. Pearse and	11711	5	9321	2390	11711	...	'85
Co.	4567	6	4567	...	4127	440	'84
Raylton, Dixon	6134	5	2756	3378	6134	...	'85
and Co.	6731	12	6731	...	6391	340	'84
Craig, Taylor	1351	3	1351	...	1351	...	'85
and Co.				...		...	
Craggs & Sons	376	1	376	...	376	...	'85
	3699	3	3699	...	3699	...	'84

CLYDE INDUSTRIAL NOTES.

NO orders of any consequence have been received by Clyde shipbuilders or engineers since our last report appeared in the December number, so that little or nothing new falls to be chronicled in this connection. All the establishments having any work on hand at all have now fairly resumed active operations after a week or 10 days, and in some cas s two, and even three weeks, cessation at the New Year. The present may be a fitting time, therefore, to give in general terms the nature and extent of the work which our great industrial establishments have on hand to keep the chimney smoking, the machinery revolving, and the brain and muscle of the hardy artizan in exercise, until that acc ssion of work *does* come which all are so anxiously looking for. While the tonnage on the stocks at present is slightly greater than what it was last year at this time, being about 130,000 tons, as compared with 100,000, still there are many yards exceedingly poorly provided with work, and some remain entirely inoperative because of the want. Many thousands of workmen are in the direst distress, and but for the schemes of relief which the towns' authorities and other bodies have organised, and kept up for several months now, literal starvation would have overtaken those

having large families, and it is nothing short of astounding to find how many of them do contrive to have regiments of children of the helpless age. In Govan, as elsewhere, the Magistrates have seen it to be their duty to organise a relief fund to help the unemployed, and recently Mr. William Pearce, M.P., sent £500 towards the fund, although the amount of work on hand at the Fairfield establishment, of which he is the proprietor, is such as should give employment to by far the larger portion of the usual staff. Partick and Whiteinch are now, perhaps, the worst-off districts on the whole river, and it taxes the Burgh authorities severely to give anything like adequate relief to the suffering unemployed. Messrs. Inglis, of Pointhouse shipyard, have launched their last vessel, and nothing further is on the books. Messrs. Aitkin & Mansel, of Whiteinch and Kelvinhaugh, have been practically at a standstill for many months, and no brighter prospects open up. Both of the above-mentioned firms, however, constantly employ a goodly number of men on their patent slips repairing vessels. Messrs. D. & W. Henderson, of Partick, have only one vessel on hand, and that but a steam yacht of about 900 tons, from the designs of Mr. G. L. Watson.

This does not by any means exhaust the dark side of affairs in the shipbuilding yards, but it may be taken as representing the deepest shade of the gloom which hangs more or less over all the districts on the river. The yards which are more fortunately situated as to work, and the extent of the more important contracts on hand may now be briefly noticed. The two most expensive ships being built on the Clyde at present are the two belted cruisers of 5,000 tons and 7,500 H.P., each for the British Government, in the yard of Messrs. R. Napier & Sons, Govan. Another pretty large order is the five torpedo cruisers of the "Anchor" type, 1,630 tons, and 4,000 H.P. each, for the Government, in the yard of Messrs. J. & G. Thomson, of Clydebank. The largest vessels, however, presently on hand in the river are the two North-German Lloyd's steamers of 5,500 tons and 7,000 H.P., each in the Fairfield Works, and the Royal Mail Liner of 4,500 tons and 5,000 H.P., in the yard of Messrs. Caird & Co., of Greenock. Two steel steamers of considerable tonnage, 3,600 tons each, are on the London and Glasgow Shipbuilding Company's stocks for the Glen Line. Messrs. Inglis, of Pointhouse, have just launched a 4,000 tons steamer, built on "spec," and a steamship of somewhat larger tonnage is about to be sent off the ways by Messrs. Denny, of Dumbarton. The total amount of work on hand in the Fairfield establishment reaches as much as 17,350 tons, and about 30,500 I.H.P., which, considering the long period of dulness from which this great establishment has just emerged, must be considered gratifying. The vessels on hand are: two steel screw steamers, each of 5,500 tons and 7,000 H.P., already noticed, for the North German Company's Atlantic Service; three steel paddle steamers of 1,650 tons each, and 4,000 H.P., for the Zeeland Steamship Company's Continental trade, and a steel paddle steamer of 1,400 tons and 4,500 H.P., for Mr. William Pearce, M.P., in all, six vessels. Messrs. Scott & Co., of Greenock, rank next to the Fairfield Works in the matter of tonnage in hand. This amounts to 15,100 tons, and consists of five steel steamers of 2,600 tons and 2,000 H.P. each, to the order of Messrs. John Swire & Sons, London, and a steel sailing vessel of 2,100 tons. The work on hand in Messrs. R. Napier & Sons amounts to 10,000 tons and 15,000 H.P., in addition to which they are constructing engines of about 10,000 H.P., triple expansion type, for the Russian Imperial Navy. Messrs. J. & G. Thomson's work totals nearly 10,000 tons and 21,000 H.P., while several firms have totals ranging from 5,000 to 7,000 tons, including Messrs. Barclay, Curle & Co., Messrs. Russell & Co., Port Glasgow; Messrs. McMillan & Son, and Messrs. Denny & Bros., Dumbarton; Messrs. Stephen & Sons, Linthouse; Messrs. Caird & Co., Greenock; The London and Glasgow Company, and Messrs. Charles Connell & Co., of Scotstown. The three first-named firms have their work chiefly in sailing tonnage. Mr. W. B. Thompson, of Whiteinch, it may be added in this connection, has pretty well advanced the *Perseverance* and *Tarapaca*, two iron four-masted sailing ships with double bottoms, of 2,430 tons each, for Messrs. A. D. Bordeo & Sons, Bordeaux, and intended for their South American trade.

With regard to the prospects of the shipbuilding trade and its twin industry of engine construction, nothing whatever can be offered with assurance. No great development of shipbuilding can be looked for so long as the freight market remains in its present state—it might be said of almost utter collapse. The vacancies in sailing and steam fleets occurring through disasters, or natural decay, are more than met by the surplus tonnage lying by, and the bulk of new tonnage being produced may be accounted for on such grounds as these:—the abnormal depths to which labour and prices of material have come tempt companies of good standing to invest, especially when the economical advantages of employing steel as the structual materal, and the triple expansion type of steam engines as the propulsive power, are facts clearly recognised. Viewed from this standpoint, a continuation of even the present degree of activity can scarcely be too confidently relied upon.

An interesting epoch in the history of the firm of Messrs. R. Napier & Sons was marked by the launch of their four-hundredth vessel—the *Mirror*, for the Eastern Telegraph Company, and was fittingly commemorated in the evening of the launch, the 21st December—when the firm entertained their large staff of officials and foremen in the M'Lean Hotel, St. Vincent Street, Glasgow. Mr. A. C. Kirk, the eminent Clyde engineer, and senior partner of the firm, presided, and was supported by Messrs. John and James Hamilton, the other members of the firm, and several gentlemen connected with the British Navy and the Eastern Telegraph Company. The croupiers were Mr. Bruce Harmann, manager of the firm's Lancefield Engine Works, and Mr. George Agnew, manager of the shipyard, supported by Mr. Charles F. Jones, cashier, &c. After a sumptuous dinner, and the usual patriotic toasts, the chairman made some interesting observations on the circumstances which had brought the company together, remarking that four hundred was a respectable number, and a pedigree which had kept its place in the world, and was looked up to, was always worth looking back upon. He then entered upon the early history of Robert Napier, the founder of the firm, and traced his remarkably successful career as an engineer and shipbuilder. In closing, Mr. Kirk said:—"The firm of Robert Napier & Sons had been pretty well to the front through the whole of the history of marine engineering. They had trained and sent out a great many men now well-known in the world—men who co-operated with them and helped on the success of the firm. The Messrs. Thomson were long trusted men in the works, and Mr. John Elder and many others had been in the works. There were present a large number of men on whose co-operation they depended, and he hoped that that co-operation would go on with best wishes on every hand, each working to the other's hand, because it was only by that means that success could attend an undertaking of such dimensions as that with which they were connected."

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The strike of operatives in the iron departments of the shipbuilding establishments, which commenced on the 7th inst., has greatly hindered operations, and in some instances practically put a stop to them. A meeting has taken place between the employers and the representatives of the workmen, but without having the desired result of bringing about an amicable settlement. The Mayor of Newcastle has also intervened, with the view of reconciling the existing differences, but his well-meant effort was equally resultless. The longer the dispute lasts, the more men who have no direct connection with it are being laid idle, and in a short time, unless a settlement is effected, a general closing of the yards will be necessary. Messrs. Swan & Hunter, of Wallsend, have already found it necessary to resort to this step, and all the workmen and apprentices in their employ were paid off on the 16th inst. This is one of the few firms which has lately shown symptoms of improved business, and it is much to be regretted that they have had to suspend operations, almost as soon as they had commenced them. The other yards where there is work in hand, are still carrying on operations on a limited scale by the aid of the apprentices. At the Elswick yard, the number of the latter is small, and not much work can be done; but at Messrs. Palmer's establishment, Jarrow, the case is different, there being a good many apprentices employed, who manage to keep some of the most pressing contracts in progress. There have been no new orders placed this month, and very few repairing jobs of importance have come to the river. According to a recent statement issued by the Tyne Commission, the number of idle steamers in the port on January 8th, was 95, with an aggregate tonnage of 75,204 tons, and 30 sailing ships, whose total tonnage amounted to 21,990 tons. The state of business in the marine engine works has not been improved since last month, and until a settlement of the shipyards dispute is brought about, no improvement need be

looked for. Foundries are generally very slack, but at one establishment (Messrs. Chapman & Carverhill's, Elswick) trade keeps brisk, and a good many heavy castings for triple expansion engines are being turned out. These are principally for Messrs. Dickinson, of Sunderland, and Messrs. W. Richardson & Co., Low Walker. Work in the locomotive shops is very scarce, and few hands are employed. In the engineering establishments where machinery and appliances of a special kind are manufactured, business continues dull. Messrs. Armstrong, Mitchell & Co.'s great works continue to offer a very remarkable contrast to the general inactivity, the ordnance shops, hydraulic machinery shops, and other equally important departments being still kept going night and day. The finished iron trade on the Tyne is, perhaps, more depressed than at any other centre in the country. The principal rolling mills at Gateshead, though not permanently closed, are very seldom working, and those at Jarrow have not been in operation since the opening of the year. The state of the crude iron trade is somewhat better, there being six blast furnaces in operation against four that are standing idle. The steel manufacture is showing some prosperity, particularly at Messrs. Spencer's establishment, Newburn, where orders for new work come in rapidly enough to keep the completed contracts replaced. The new steel works at Jarrow and Elswick are as yet only in partial operation, but it is understood that in each case there will be plenty of work forthcoming when the establishments are fit to deal with it. Chains and anchor manufacturers, although they have considerably reduced their quotations, are still unable to find work upon which to employ their operatives, there being no demand whatever for these kinds of goods on home account. One firm, however (Messrs. Hawks, Crayshaw & Sons), are keeping some of their heavy chainmakers employed upon a Russian order.

The Wear.—The wages difficulty has prevented the re-opening of Messrs. Bertram & Haswell's yard, which event we announced last month was to take place early in the new year. Messrs. J. L. Thompson & Sons, of North Sands Yard, have added to their plant during the month a new and powerful planing machine for planing the edges and ends of shell plates. It is long enough to admit for planing at one time two plates having a longitudinal measurement of 15 feet each, and its introduction just now is especially opportune, in view of the fact that the tendency to increase the dimensions of ships' plates is daily growing stronger. This firm, who were busy during the whole of last year, have still a good deal of work in hand, there being five large vessels on the stocks (one in an early stage), while the preliminary work of another is proceeding. The Sunderland Shipbuilding Company have launched a vessel this month, and so have Messrs. Boolds & Sharer. The latter firm, who have one very large vessel on the stocks, have kept their yard working during the continuance of the strike, as they are not connected with the employers' association. Messrs. Short Brothers have also kept their yard in operation, being placed in somewhat similar circumstances. The last named firm are very well situated for work, there being two large vessels in progress and one in the preliminary stage. The firm are about to launch a vessel that has stood on the stocks completed for a couple of years. In the marine engineering industry, the only works in this district that are showing any signs of vitality are Messrs. Dickinson's and the North-Eastern Company's establishment, South Dock. Messrs. Carr & Co. and Messrs. Clark have very little work, and are paying off men, and at Messrs. Doxford's establishment the state of matters is no better. The ironfounding business is still greatly depressed, but, despite this fact, a foundry at Monkwearmouth, which has been for some time closed, is being got ready for starting again. The rolling mills at Fulwell are kept pretty well employed, being steadily patronised by those shipbuilders in the district who have iron vessels in hand. Of seven forges in the district only one or two are having any work, and these but a very limited quantity.

The Hartlepools.—The three shipbuilding establishments at the Hartlepools are slack, one of them having only some repairing work in hand. There are only three small steamers in progress at Mr. Gray's yard, which for many years has occupied a foremost position in the annual returns of tonnage launched, and which in all previous slack periods has been kept comparatively busy. Messrs. E. Withey & Co. have one large vessel on the stocks, the plating of which has just been commenced. There are three berths empty, but it is understood that the firm have another vessel to lay down in one of them. In the marine engineering trade the state of matters is rather better than in the shipbuilding trade. Messrs. Richardson & Sons, who, during the past year, have engined a good many Wear built vessels, have still some engines and boilers in hand for Sunderland builders. Just now there is work enough in progress to keep a full complement of hands engaged. The Central Marine Engine Works are also very well employed, and there is a probability that a night shift will shortly be put on in some of the departments. The plate mill at the West Hartlepool Iron Works is kept working steadily, but the other departments have been standing for some time. The importation of timber being practically suspended during the winter months, there are now a great many men out of work who, in the season, find employment in discharging vessels and storing the cargoes. These, along with the men laid idle from the shipyards and other industrial establishments, form a very large army of unemployed, and, as may be supposed, distress in a very acute form exists.

The Tees.—At Middlesbrough the extensive shipbuilding yard of Messrs. Raylton Dixon & Co. continues in operation, the notice for a reduction of wages, which expired on the 20th Jan., having been withdrawn. The firm have a considerable amount of work in hand, and very fair prospects for the future. A new yard, of extensive area and superior appointments, which was projected during the late busy period, is still unoccupied, and it is to be feared must remain so for many months yet. Only one of the three yards at Stockton has any work worth speaking of, and operations at this establishment are stopped through the wages difficulty. Messrs. Blair & Co.'s engineering works are kept comparatively busy, but other establishments of the same kind are having very little work. The Eston Steel Works continue in steady operation, but many of the ironworks in the district are standing idle, and hundreds of operatives are out of work.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

THE ALMQUIST MARINE ENGINE GOVERNOR.

To the Editor of The Marine Engineer.

Sir,—Referring to a letter from a Mr. Burnett, in Hartlepool, in the last number of your paper, page 273, and also some month ago in *Engineering*, I beg you will now allow me to answer the same.

When I first saw Mr. B.'s letter in *Engineering*, and there finding how very little he in reality knows about marine-governors in general, and especially about the claims made in *his* specification, my intention was to leave it without any answer. Mr. B. seems, however, to have misunderstood this silence, and, although a rather daring and unwise undertaking, he sends his more or less provoking epistles over to your paper, and I have now no longer right to be silent.

My Letter of Patent is numbered 14,146, 1884, that of Mr. B. 14,520, 1884.

I claim (*a*) to be the first, as far as I know, having showed the way in which "cataract" and other governors can be made without stuffing-boxes, and thereby having more resistive and constant effect than hitherto, and (*b*) the valve arrangement showed in the December number of this paper, page 241, fig. 2. The method of using this governor is not, in details, mentioned in the specification, and has indeed nothing to do with the apparatus itself.

Mr. B. claims, not only in his specification, but also by his said letter, that he imagines himself to be the true inventor of—

(1) The method of producing direct communication between the condenser and the exhausts of the different cylinders, and moving the closing valves by the governor.

(2) To distribute the steam by these valves "in such manner as to apportion the work to be done by each cylinder as desired," &c.

(3) "The application of double-beat valves substantially as and for the purposes set forth."

(4) "The float governor," &c., "as described with reference to the accompanying drawings."

I will now only ask Mr. Burnett if he can be so ignorant in this matter that he does not know—

1st. That in communications between receiver and condenser is an old arrangement? If I do not make a mistake he will, however, find constructors using the same, although not especially for governing, at Poplar, Chiswick, Havre, St. Denis, at La Seyne, and Spezzia, &c. In London is also a respectable firm, which for years has been using this principle for governing the speed and to prevent "racing."

2nd. That it is far from a necessity to distribute the steam in the complicated manner as in claim (2). Here the want is to reduce or wholly annul the effect of the engine and not to have a perfect regularity during the revolution. More practical arrangements are given!

3rd. That "double-beat" valves, as in claim (3), are not the only suitable valves for the purpose. I myself, and with me many others, consider piston-valves and cylindrical cocks better.

4th. That the "float-governor" mentioned in claim (4) is patented over and over again. Mr. B. shows in his specification such a governor of the most primitive forms, and it seems to be similar to that exhibited at the Inventions Exhibition last year, and patented by Mr. S (?). This governor did receive none of the three medals given for marine governor, its inferiority to others thereby clearly shown.

The result of the said being that Mr. Burnett's patent, No. 14,520, 1884, can be considered as of no practical value, and that any one may use the same principles in method as well as in apparatus. This as far as a marine engineer and naval architect can see.

The whole can easily be tested, and will show that Mr. Burnett, without any right but of ignorance, has accused me and the "Almquist Governor."

I would now give Mr. B., and all other "amateurs" in marine governors, the wanted advice, neither to apply for a new patent nor to write about any similar subject without first having made sufficient studies at the Patent Office. Neglecting these you will make the same mistakes or similar to those now made by Mr. B. Don't trust the Patent Agents!

I hope later on to have an opportunity to give you a review of the most known and most used marine-governors. I will therein try to state the faults and merits of either of those as well as when to use the one or the other. This seems now to be a very wanted thing, not only for the engineers but also to all shipowners.

Yours truly,

FRIDOLPH FRSAN ALMQUIST, C.E., N.A.

On board the s.s. "Thorston."

[Mr. Almquist will find a very able article on marine governors in the February number of the MARINE ENGINEER of last year, page 285.—ED. M.E.]

LIQUID FUEL FOR STEAMSHIPS.

To the Editor of THE MARINE ENGINEER.

SIR,—I must say I read with surprise your remarks relating to the trials of the s.s. *Himalaya* with liquid fuel, in your December issue. There are some of the points required to be more fully stated, and some of the statements verified.

In the first place can it be possible, even burning liquid fuel, that a steamer of a size requiring £7 worth of coal per day of twenty-four hours, can really steam that length of time on so small an outlay as £1? The quantity of oil stated—eight gallons per hour—also seems to be very small, about three-quarters of a ton per twenty-four hours. Now suppose coal to cost 7s. per ton, we would have twenty tons of coal only doing the same amount of work as three-quarters of a ton of petroleum, and as coal and petroleum occupy weight for weight very nearly the same cubic space, a proportionately large saving in cargo space would be effected. An explanation of same, and any particulars regarding the pipes and nozzles required for the oil and steam jets, the influence on the furnace and combustion chamber plates, both as to the direct impact of the flame on the one side, and the salt on the other, by you or any of your correspondents would, I am sure, be of the greatest interest and value to many other of your readers as well as myself.

I am, yours truly,

J. BOWER.

SIR,—Reading in your issue of the present month the report on the results of the trial of the s.s. *Himalaya* with liquid fuel, on the voyage from London to Granton, and being much interested in this subject I visited the *Himalaya* twice whlie laying at Granton. The first time the Chief Engineer explained all the benefits he had derived on the voyage from Gravesend to Granton. While burning coal, he informed me, the average speed per hour was 8 knots, with a consumption of 8 to 9 tons of coal, but on the voyage from Gravesend to Granton, using the liquid fuel, they got better steam. Having no fires to clean, they lost no steam whatever, therefore they got more revolutions out of the engines, the average speed being $9\frac{1}{2}$ knots an hour—an increase of $1\frac{1}{2}$ knots over the coals—the time occupied on the passage being 54 hours, which, I must say, is only an average of barely 7 knots. The second visit to the *Himalaya* was after the improvements were made, and to see steam up. In my opinion, the fires were as good as obtained by coal, but the heat, I am inclined to think, was mainly in the furnace, the tbues being a very small assistant in the shape of steam-making, there being little or no heat visible at the smokebox end; the furnace I think has, therefore, the principle part of the work to do. If furnaces are subjected to such severe tests by using liquid fuel, I am afraid they will give any amount of trouble and expense. As regards the expense of fuel, the patentee told several other gentlemen, along with myself, he would use 40 or a little over 40 gallons per hour; the cost of the oil by report is $1\frac{1}{2}$d. per gallon; using say 45 gallons an hour would equal £5 12s. 6d. per day for oil; burning 9 tons of coal per day, steam coals can be got under 10s. per ton, putting on board 1s., say 11s. per ton, would equal £4 19s., the three firemen at 4s. per day, would equal £5 11s., leaving a small balance in favour of coal; the keep up of furnace bars, &c., for coal, compared with the same for oil, as bricks, &c., will stand greatly in favour of coal, I think, as the brick arch in the furnaces for using liquid fuel will require to be re-built every few days. The loss of fresh water by the steam used for the blast is also another drawback. This, of course, could be got over, but not without considerable extra expense. I would like if any of your numerous correspondents could give any more information on this subject. Apologising for trespassing on your valuable space, I am, yours truly,

Leith, *December 28th*, 1885. ENGINEER.

Review.

The Shipping Diary, 1886. Published at 7, Leadenhall Street, E.C.

WE have before us a sample of the first issue of this diary, which promises to occupy a position not hitherto filled by any such diary, since, in addition to the diary, it provides a compilation of information for the daily use of the shipping and mercantile community. This information necessarily commences with all details of Inland rates of postage, registration, parliamentary proceedings, petitions to parliament, &c., care being taken that the information is particularly minute for foreign parts and the colonies. The lists of custom duties and licences on passenger boats of the United Kingdom are particularly serviceable to the class for whom the shipping diary is intended. A very complete list of Lloyd's agents in all parts of the world is also given, with the signal stations established by the committee of Lloyd's. The list of ports where pilotage is free or compulsory, with a revised copy of the regulation to prevent collisions, at sea are all of great value. Considerable detail is given to the extracts from the prospectus of the Manchester Ship Canal, though we fail to see of what great value this item can prove except by way of a capital advertisement for the undertaking. A list of the London ship owners and of the Steam and Navigation Companys, with various marine boards are probably likely to prove of interest to the shipping community, and the transcripts of the Merchant Shipping Act and others of a similar character will be useful for reference. Altogether the idea of this diary, for a community with special interests and need of special information, is a good one, but we can only as yet consider it in embryo, and we shall expect considerable addition, and perhaps excision from the information it professes to give in the succeeding issues with which we hope it will be blest.

THE Austrian Lloyd's Company is going to inaugurate a new service of fast steamers between Trieste and Alexandria. Two fine vessels, which are to run 14 knots an hour, are being built in this country for the purpose.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from December 16th to 31st, 1885.

15445 The Temple Patent Balanced Slide Valve Company and J. C. Freeman. Regulating steam to steam engines.
15470 C. Blagburn. Burning liquid fuel in furnaces.
15472 J. C. Williams-Ellis. Generating steam.
15478 W. Maxwell. Exhaust pump.
15482 J. Settle. Furnaces.
15483 J. Burton. Sight feed lubricators.
15494 A. J. Jarman. Reversible water, steam, or other fluid motor.
15498 H. Field. Packing for steam and other engines.
15499 H. Field. Joints for steam, hydraulic, and like apparatus.
15500 J. J. Galloway and G. McFarlane. Packing for stuffing boxes
15501 W. E. Heys. Valves of vacuum air pumps.
15526 Imray (J. Parrington). Packing for piston rods.
15534 D. Hunter. Regulator for the dampers and the doors of steam boiler furnaces.
15537 Lake (E. Berlingieri). Mariners' compasses.
15543 J. Lyle. Pressure reducing valves.
15546 J. H. Lynde and J. O. Holt. Sleeping berths.
15562 T. J. Lindsay. Haulage clips.
15563 T. G. Redstone. Engines or pumps.
15573 J. Etherington. Sight feed lubricator.
15580 J. Walker. Oil cans or feeders.
15584 C. J. Ball. Dredging apparatus.
15586 C. J. Ball. Centrifugal pump.
15596 R. McWhirter. Ships' berths.
15601 W. C. Johnson and S. E. Phillips. Gripping cables.
15602 T. Marshall. Ships' lamps.
15611 T. S. Tongue. Ships' lamps.
15614 W. Menzies. Artificial fuel for marine and other boilesr
15618 W. Hartcliffe and W. H. Malkin. Valve for water gauges, &c.
15620 W. E. Walker, W. Peile, and W. Cook. Feed water heater.
15639 C. A. Knight. Steam boilers.
15644 F. B. Salmon. Cranks for marine engines.
15647 J. T. Hailwood. Light feed lubricators.
15655 A. P. S. Jones. Regulation of admission of steam to steam engines.
15656 H. Moore and J. D. Pollard. Hydraulic engines.
15666 W. Hutchinson and C. Thompson. Controlling the draught of furnaces.
15670 W. W. Kay. Removing deposit from steam boilers.
15677 R. Barker. Steam pipe joints.
15686 W. M. Fraser. Furnaces.
15692 J. Wakefield. Rotary steam engines.
15694 The Patent Oxonite Co. and R. Punshon. Blasting cartridges and detonators.
15695 S. H. Emmens. Projectiles for operations of war.
15696 S. H. Emmens. Smokeless gunpowders.
15697 S. H. Emmens. Explosive substances.
15698 A. A. Rickaby. Packing for piston rods.
15707 E. Blass. Slide valves and cocks.
15711 H. F. Swan. Navigable vessels.
15712 J. Vavasseur. Gun mountings.
15720 P. W. Willans. Cooling bearings.
15722 E. Marten. Receptacles for gunpowder.
15734 Allison (E. H. Hall). Screw propelling apparatus.
15754 C. Wells. Floating anchor.
15755 C. Wells. Means of communication from ship to shore.
15762 A. G. Martin. Obtaining superheated steam at a constant temperature.
15770 Newton (C. C. Worthington). Direct acting engines.
15771 Newton (C. C. Worthington). Packing piston or other rods.
15776 C. McWhirter. Steam ventilating apparatus.
15785 J. Thom. Valve gearing.
15793 D. Jones and J. Brunt. Rocking bars for all kinds of furnaces.
15795 J. Howden. Steam boilers.
15798 J. M. H. Taylor and L. Benjamin. Ships' rudders.
15801 J. D. Noble. Lubricators.
15812 J. W. Restler. Steam generators.
15832 G. Pickersgill. Manufacture of land and marine boilers.
15838 J. Blake. Motive power engines.
15857 T. Andrews and T. Grant. Metallic packing for glands, stuffing boxes, &c.
15883 A. F. Yarrow. Launching torpedoes.
15884 A. F. Yarrow. Supplying air to steam boilers.
15888 Kühne (R. Proell). Expansion gear of steam engines.
15900 Bapty (W. H. Campbell). Self-closing doors for water-tight bulk heads of steamships.
15909 A. B. Wilson. Steam engines.
15927 T. Witter. (Back pressure) valves.
15930 I. Henderson. Governor for marine boilers.
15935 A. Montupet. Tubes for steam boilers.
15951 Allison (H. M. Bartlett and W. H. Brown). Fluid meters.
15964 H. R. Robertson. Rafting logs for deep water towing.
15969 J. Archbold. Clips for endless rope haulage.
15972 N. H. Humphrys. Preventing explosions of steam boilers.
15983 Clark (E. Amouroux). Low water alarm for steam boilers
15999 Boult (D. F. A. Decaix). Distributing valves.
16004 B. W. Maughan and L. D. Waddy. Propellers.
16013 T. McCarter and T. Cooper. Motive power engines.
16014 J. Laidlaw and A. J. Liversedge. Construction of centrifugal machines.

BOARD OF TRADE EXAMINATIONS.

Note.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

December 26th, 1885.

Adams, Chas. E. 2C Liverpool
Atkinson, G. H. 1C Hull
Barnett, J. C. .. 1C London
Darley, W. G. F. 1C ,,
Eames, R. H. .. 2C ,,
Gibbons, Wm. G. 2C Hull
Godfrey, W. L... 2C London
Harding, G.J.W. 2C Hull
Knoch, Alwin .. 1C London
Landye, Thomas 1C ,,
Mackay, Adam B. 1C ,,
Martin, Robt. .. 1C ,,
Muir, Wm. .... 2C Liverpool
O'Sullivan, Rich. 1C Hull
Oxley, Frank .. 2C ,,
Pert, George .. 2C ,,
Robinson, R. J. 2C London
Skipworth, G. P. 2C ,,
Stevenson, James 2C Hull
Thompson, Wltr. 2C London
Waters, A. G... 2C ,,
Watters, W. H. 1C Liverpool
Miller, Wm..... 2C Glasgow
Mitchell, J. P... 1C ,,
Morton, Thos... 1C ,,
O'Sullivan, Tim. 2C ,,
Ridyard, W. R. 2C Liverpool
Shanks, Alex. .. 2C Glasgow
Smith, Thos. S. . 1C ,,
Stanley, Wm. H. 2C Liverpool
Stirling, Allan.. 2C Glasgow
Thomson, C. .. 2C ,,
Venn, E. G..... 1C Liverpool
West, G. J. G... 2C Glasgow
Wilkinson, R... 2C Liverpool
Williams, Thos. 1C Bristol

January 2nd, 1886.

Anderson, Chas. 1C Glasgow
Beaton, G. P. .. 1C ,,
Bond, Edwd. .. 2C Liverpool
Boyd, D. M. .. 1C Glasgow
Brown, John .. 2C Aberdeen
Campbell, David 2C Glasgow
Croal, G. C..... 1C Liverpool
Dick, Joseph .. 2C Aberdeen
Firth, David.... 2C Glasgow
Gibb, Andrew .. 1C ,,
Gordon, Alex... 2C ,,
Gordon, Jas. .. 1C Aberdeen
Gunn, Robt..... 1C Glasgow
Hanson, E. R... 1C ,,
Hean, Wm. .... 2C Liverpool
Lelly, J. R..... 2C ,,
Lynch, Henry.. 1C Cork
Marshall, John . 2C Glasgow
McAdie, R..... 2C Aberdeen
McIntyre, W... 1C Glasgow
McNee, Alex .. 2C ,,
McNeil, Jas. .. 1C ,,
McMullan, S. .. 2C Belfaast

January 9th, 1886.

Barden, G. T. .. 2C N Shields
Hovenden, F. .. 1C London
Lindsay, Wm. .. 2C Hull
Marsdin, Chas.. 2C ,,
Muir, John .... 2C Greenock
Saune, O. C..... 1C N Shields
Yates, Alex..... 2C Greenock
Williams, Joseph E1C Bristol

January 16th, 1886.

Billson, J. T. .. 2C N Shields
Chapman, Robt. 1C Leith
Corner, A. .... 2C N Shields
Darke, C. ...... 2C London
Davis, J. H. .. 2C W H'pool
Edge, A. .... 1C N Shields
Ferguson, Joseph 2C Leith
Gilman, W. .... 1C London
Glaister, G. B.... 1C Liverpool
Gray, Thos..... 1C N Shields
Hildreth, G. .. 2C W H'pool
Johnstone, J. .. 2C Leith
Law, J. C. .... 1C N Shields
Mainland, Wm. 1C Leith
Munro, Robt. .. 2C ,,
Pearson, Wm.... 2C ,,
Roedsmer, J. M. 2C ,,
Skellorp, R..... 1C Liverpool
Smith, James .. 2C Leith
Stevenson, D. I. 1C Leith
Storrier, Wm.... 1C ,,
Thompson, C.H. 2C London
Verran, W. ..... 2C ,,

The Marine Engineer.

LONDON, MARCH 1, 1886.

EDITORIAL NOTES.

THERE is so much agitation now in England as to the condition of the working classes consequent upon the depression in trade, that we may consider ourselves justified in devoting some attention to the question. It appears to us that the whole relative position of the working classes to the middle and wealthier classes is rapidly assuming a very false position. There is no doubt that much might be done and has been done to ameliorate their position and to raise them socially as a mass, but the constant efforts of philanthropic statesmen to better their position seems to be tending rapidly to impress the opinion, not only upon themselves, but on the mass of the nation, that it is the duty of those who are thrifty, and are thus enabled to weather out the period of depression, to maintain the mass of thriftless and from hand to mouth livers, on quite an artificial basis. For instance, it is well recognised everywhere that trade at present in the United Kingdom is slacker than it has been for a long period, and yet it is well known from daily reports and personal knowledge of individuals that large orders in shipbuilding and in the construction of machinery of all classes are being placed on the Continent and elsewhere, instead of in their ordinary market in England. We ourselves are personally acquainted with a case during the last few weeks in which machinery to the extent of £20,000 was ordered from Belgium by an English resident and to be paid for by English money. It is mere childishness for the workmen, or even employers, to cry out that such a case as this should be stopped by protective duties. If England cannot compete in the machinery or iron markets at home without protection, she holds a worse position than ever she did before in the great iron industry, and is on the decline. Any such artificial raising of prices in England also, by protective tariff against importation, will only tend to make it impossible for England to compete in the open markets of the world. What all the workers and employers of labour should take to heart is, that now having to compete with organised industries abroad, it behoves every man to see that he does more and better work for his wages or profits, than can be done by any other working nation of the world. That this is quite possible we firmly believe. If not, we must be content to go to the wall. Where is the remedy for this state of things? First, that workmen should frankly recognise that all the commodities of life, clothing, or luxury, are cheaper now than ever they were, and that therefore 30s. a week now really represents as much as 36s. a week did a few years back in its purchasing power. If workmen would only frankly recognise this as all the other classes of the community are forced to do when working for their own hands, we should hear no more of the disastrous strikes by which workmen foolishly attempt to artificially maintain a standard value of money relatively to labour, which is entirely contrary to the soundest principles of political economy. The workmen must also remember, instead of crying out for constant diminution of hours of labour, that they are competing with workmen abroad who work from 60 to 72 hours per week in shipbuilding yards, foundries, iron works, and machine shops, without overtime, at an average wage of 17s. or 18s. a week. In iron shipbuilding in Germany the foremen are contented with 29s. a week, and mechanics, rivetters, finishers, &c., and blacksmiths, with from 18s. to 27s. per week. If, then, the workmen here accept the lowest terms ever offered by the employers in the many trade disputes that are constantly arising, they must still do from 20 to 30 per cent. more labour than their foreign competitors in, at least, 10 per cent. less time, to bring their workmanship on a par with foreign production. Seeing the little power of realisation of these stubborn facts that exists amongst our workmen, and the absurd outcry they raise, at the slightest provocation, of tyrannous grinding down on the part of employers, there is no wonder that English manufacturing industry begins to suffer and trade to decrease. If the mass of the unemployed were only to consent by agreement to work at a reduction upon their usual wages in anything like the proportion to the need of the present period of depression, so that the employers should have security for something like a firm basis of contract at reduced prices, we have no doubt there would be plenty of work, and to spare, throughout England as heretofore. At the same time employers must remember that it is a constant complaint that English manufacturers are too apt to say to their customers, you must take what we have been in the habit of manufacturing or do without, and have nothing like the facility of American or German manufacturers in attempting to suit their wares to the market in which they endeavour to sell.

THERE is still much room for ingenious improvement in the construction of iron steamers or vessels, so as to

render them practically unsinkable even after collision, or partial injury to their hulls by striking upon banks or rocks, without thereby rendering the vessel commercially unfit for its purpose, by excessive subdivision or expensive construction. As matters now stand this may appear to be an impossibility, but the history of invention has always been that it is the scope of ingenious inventors to surmount that which appears at first sight to be an impossibility. There is much humbug extant in the commercial marine generally, as to the protection afforded by the only attempt hitherto made in this way by the use of transverse bulk heads. Practically there are very few, if any, commercial steamers or vessels divided into anything like a sufficient number of water-tight compartments, so as to ensure buoyancy after collision or partial damage to the hull. The chief exception that can be made to these criticisms is with regard to the present generally adopted construction of fore peak, which is now invariably parted off from the hull of the vessel by a bulkhead sufficiently near to the stem of the vessel to prevent foundering from an accident to the bow of the vessel. It must be remembered, however, that it is very seldom, if ever, that two vessels collide both stem on. One or other of the vessels usually receives the damage somewhere in its quarters or sides, resulting in almost certain destruction to the vessel. There can be little doubt that a large percentage of the unexplained losses of merchant steamers may be put down to collisions in which both vessels founder, and of which, therefore, no account ever reaches us. It would be a great gain to the safety of our commercial marine generally, and to the nation at large by the additional security from total loss that would be conferred, if something like a reasonable method of construction could be adopted, by which damage to any part of the hull could be localised to such an area or volume as would not dangerously affect the buoyancy of the whole vessel. Of course the commercial objections to any such system as would first present themselves to the constructor are most serious and obvious. The cargo accommodation of a steamer so provided would, at first sight, be thereby hopelessly impaired. It must be remembered, however, that the ideas hitherto developed in this direction are very limited in their nature and seem to be almost entirely confined to the subdivision of the hull by transverse bulk heads. Is it not possible that more attention to the possibility of longitudinal, horizontal, or diagonal subdivision might materially reduce the disadvantages of such a system? Again, might it not be possible for such subdivisions to be effected to such a degree after the cargo has been stowed, as to leave the largest space available for stowage and removal of cargo whilst subdivision might be effected when in transit? As the construction of bulkheads is at present carried out, much criticism also may be fairly given upon the absurdity of such bulkheads being insufficiently strong to carry the water pressure for which they are designed in case of accident. It must be remembered that when called upon to fulfil their purpose of giving buoyancy to a vessel they are to all intents and purposes fulfilling the same function as the hull, and must therefore represent considerable resisting power. Frequent reports as to the action of collision bulkheads after damage to the stem of the vessel have shown that it is usually only with the greatest difficulty and with considerable shoring that the collision bulkheads can be made to carry the necessary water pressure. Their flat form renders them exceptionally weak in their capabilities of resistance, but we do not know why flat bulkheads should be so universally adopted, as we see no serious objection to make them curve convexly to the axis of the vessel. This would render them much stronger than could ever be the case with flat bulkheads for carrying pressure on the concave or convex surface.

Mr. Nordenfelt's new invention of the submarine torpedo boat is not likely to become obsolete for want of sufficient publicity. We see that Mr. Nordenfelt has been reading a very interesting paper at the United Service Institution upon the subject, and introduced his subject by a slight analysis of what had been done before in the same line of research. He considers that all previous designs have failed because they were small and weak; because they tried to act by actual contact with the enemy's ship's bottom, which was very dangerous and difficult, especially if the ship was pitching at all; and further, because an unsuitable explosive, such as the ordinary powder, was used; propulsion was effected by hand for which an ordinary crew would be unfit, whilst the means of ascending and descending were untrustworthy. Mr. Nordenfelt considers that he has avoided these difficulties by making the boat of 60 tons displacement and 100 engine H.P., so that it shall be capable of showing fight and holding its own, either above or under the water. There is much, however, to be desired yet in its speed, which is only some 9 knots, though the boat is capable of running 150 miles at this speed without re-coaling. It is intended to run on the surface, but blows its smoke out under water so as to be as invisible as possible. When it nears the enemy it is intended to descend and move "awash" with a cupola alone above

water. When even this is liable to be seen she can descend altogether under water by means of the propellers. Mr. Nordenfelt attaches the greatest possible importance to three details in particular: (1) The employment of heated water to give off steam as an unfailing reservoir of energy; (2) The submersion of the boat by mechanical means, which is much safer than depending on specific gravity (because, practically, the density of water alters so slowly with the depth, that a vessel which descends below the surface may descend to a great depth), and upon cessation of working the boat naturally tends to rise; (3) The use of rudders to keep the vessel always horizontal. There is no difficulty experienced by insufficiency of air or by too great a heat. The turtle back of the boat materially protects it against machine or quick-firing guns, both from its obliquity to the direction of fire and of the thickness of the steel plate that can be conveniently carried. When "awash" the water will also protect the vessel. The attack of such a torpedo boat when "awash" and practically unassailable would evidently be very dangerous, as no doubt under such circumstances a torpedo might be devised which should be capable of piercing any protective net, and at the same time remain under electrical control from the submerged torpedo boat.

"Modern Shipbuilding and the Men Engaged in it."—Correction.—In the notice of this interesting work given in our last issue, the name of the author was inadvertently given as Daniel Pollock. From the advertisement to be found on page x. of the present issue it will be seen that the author's name is David Pollock.

Shipbuilding and Shiprepairing at Newport, Mon.—As regards shipbuilding and shiprepairing at Newport, it may be mentioned that notwithstanding the great depression in shipping trades throughout the country, the following information will at once show our readers that Newport has not suffered to such an extent as many other ports—thanks to the rapid strides the port has made during the past few years, and the river being quite as well adapted for launching as the Tyne, Wear, and Tees. Only a few years ago Messrs. Mordey, Carney & Co., Limited, had three steamers at one time on the stocks at the Dry Dock Yard, and nothing but orders are wanted to enable that firm to carry on an extensive business in this department, and we trust the time is not far distant when such orders will be forthcoming. During the year Messrs. Mordey, Carney & Co., Limited, launched from their works three vessels, one of which was fitted out completely with engines and boilers made on the premises. Shiprepairing has not been so brisk as in previous years, owing to the number of steamers lying up for want of remunerative freights, and the increased dry dock accommodation now afforded throughout the kingdom, more especially in the Bristol Channel ports, where it may be stated, dry docks have increased in number and extent to more than cent. per cent. during the last few years. During 1885 Messrs. Mordey, Carney & Co. have docked and repaired 326 vessels against 333 in 1884. Some of the vessels have undergone extensive repairs with very prompt despatch, and a large number which would otherwise have been sent to other ports for repairs were induced to come to Newport through a reduction that has been made in graving dock dues. The facilities now possessed at the Dry Dock Yard as regards executing work with economy and despatch are such as cannot be surpassed by any other firm in the Bristol Channel. The firm of Messrs. Mordey, Carney & Co., Limited, have been added to the Admiralty list of contractors for repairing and building small Government vessels.

JAMES WATT ANNIVERSARY.

Celebration by Clyde Foremen Engineers.

The anniversary dinner of the foremen engineers of the Clyde, in honour of the third jubilee or 150th anniversary of the birth of James Watt, was held on Saturday evening, the 23rd January, in the Grand Hotel, Charing Cross, Glasgow, under the genial presidency of Mr. John Ward, of the Leven Shipyard, Dumbarton. The occasion was marked with all that enthusiasm and *esprit de corps*, for which these annual dinners are famous. The chairman was supported by Mr. F. H. Underwood, Consul for the United States; Mr. Peter Denny, jun., of Messrs. Denny & Co.; Captain Kerr, of Greenfaulds, Cumbernauld; Mr. T. A. Arroll, of Messrs. Arroll Brothers, Germiston Iron Works; Mr. F. W. Dick, of the Steel Company of Scotland; Mr. J. P. Wilson, general manger with Messrs. J. & G. Thomson, Clydebank; Mr. William Arroll, of Forth and Tay Bridges fame; Mr. T. B. Seath, of Rutherglen; Mr. J. H. Biles, of Clydebank Shipyard; Mr. C. H. Johnson and Mr. F. P. Purvis, of Leven Shipyard, Dumbarton; Mr. W. J. Millar, the Secretary of the Institute of Engineers and Shipbuilders in Scotland; Mr. Holmes, of the North British Railway, who is the croupier-elect for next anniversary; Mr. W. Donald, of Messrs. Hannah, Donald and Wilson; Mr. Geo. Agnew, manager with Messrs. R. Napier and Sons; Mr. Macmillan, manager with Messrs. Inglis, Pointhouse; Mr. J. Walker, of Messrs. Lobnitz & Co., Renfrew; Mr. J. Barrow, of Messrs. Shanks & Son, Johnstone; Mr. John Darling of the Union Steamship Company, of New Zealand; Mr. Dodd and Mr. J. Mollison, of Lloyd's Register; Mr. J. Williamson, of Barclay, Curle & Co., &c. The croupier's chair was filled by Mr. G. Russell, Motherwell, who is president-elect for next anniversary. The gathering, which numbered about one hundred and fifty, also included many of the leading members of the trades interested on the Clyde.

The chairman, in submitting the toast of the evening, "The Memory of James Watt," gave a succinct and choicely worded *resumé* of the life and work of this illustrious engineer. In introducing his subject, he said: "Just as we love to remember in our family life, and our national life, the birth anniversaries of those near and dear to us, or who have done well for their country, and deserve well at our hands, so do we, or we ought, as lineal descendants of our patron saint, take pleasure in meeting together to celebrate this the third jubilee anniversary of his birth, and hear once again of the intellectual battles he fought, of the victories he gained, and of the honours he won. Battles none the less real because they were bloodless. Victories none the less enduring and of lasting benefit to his country and to mankind in general because they were peaceful, and honours which deservedly crowned him with wealth and fame, but which fell far short of what would doubtless have been his had his battles been of a military character, and his victories gained at the loss of precious lives, and the desolation of many hearths and homes."

Having traced in a highly interesting way the early efforts and later successes of Watt, the speaker said that it was a duty lying on "any one proposing this toast to bring to remembrance the great help Watt had received from that great and inventive genius who was so closely associated with him in his later improvements on the steam engine. I refer to our countryman, William Murdoch. This great and original genius was engaged by Boulton and Watt in 1777 (three years after their commencement in business) first as a mechanic at 15s. a week, and latterly in directing the erection and working of the mine engines set up by the firm in Cornwall, the salary given him by them for this work being £1 per week. At the age of 44 he asked for an increase, and not receiving a prompt reply he resigned his position. As a result of this the firm showed the appreciation in which they held him by offering him the general managership of their works at a salary of £1,000 a year, which he accepted. But that his resignation had taken place before any tangible appreciation of his worth was given by the firm, even when holding a position of trust, leaves an unpleasant feeling in the minds of impartial thinkers. As the inventor of the first locomotive engine, of the first oscillating and the first slide valve engines, Murdoch showed his wonderful ability and genius; but especially as the founder and inventor of gas lighting will his name ever be best known to mankind. If, however, Boulton and Watt made scant recognition of his worth until compelled by his leaving them to do so, what shall we say of those who have for many years taken the free gift which he gave to the world, and especially those who have and

are making large fortunes thereby, without any recognition whatever. Right glad am I to know, gentlemen, that there are some members of his profession with us this evening who are at this moment striving to atone for past neglect, and in the success with which their efforts for a national memorial to him are being crowned, are doing honour to his memory as well as to the profession which they themselves adorn."

Speaking of later times the speaker concluded "While great improvements have since been made upon the steam engine, yet in essential points it still remains as Watt left it, his successors in the profession being content if they could simply add their stone to the structure whose foundations have been so firmly laid. The men of the Clyde, and particularly members of this association, have pride in knowing that the greatest improvements on the steam engine since the days of Watt have emanated from brains trained as his was, on the banks of the Clyde. Notably surface condensation and the compound marine engine; while more recently engines with great pressures, and triple and quadruple expansions are the latest laurels of the profession. And so the steam engine goes steadily forward on the march of progression, until now we see it the great lever which has influenced society, and brought about more changes upon the face of the world than any other power. Steam navigation has also made great progress within the last 25 years. True we had the *Great Eastern*, which must ever remain a tribute to Brunel & Scott Russell's genius, but as a profitable and speedy steamer she was never successful. Dr. Lardner in 1835, addressing a Liverpool audience, said—'As to the project which was announced in the newspapers of making the voyage directly from New York to Liverpool, it was, he had no hesitation in saying, perfectly chimerical, and they might as well talk of making a voyage from New York or Liverpool to the moon.' That declaration can never be more fitly recalled than at a time like this, when marine engines admit of vast power being packed in little space—when we have steam at sea as on shore, cheaper than the unbought wind, and when enormous floating palaces are constantly making the passage in a little over six days. What further advance remains to steam navigation it would be unwise to conjecture, but we know that at the present moment we are building on the Clyde vessels to beat the highest speeds we have yet reached, and even then the limits of steamship achievements will not be defined."

Succeeding toasts were "The Trade and Commerce of Glasgow," submitted by Mr. J. M. Cherrie, of Parkhead Forge, and responded to by Mr. Underwood, U. S. Consul; "The Association of Foremen Engineers," proposed by Mr. P. Denny, jun., and replied to by the Croupier; "Shipbuilding and Marine Engineering on the Clyde," proposed by Mr. W. J. Millar, replied to by Mr. J. P. Wilson; "The Iron and Steel Trades," proposed by Mr. J. Turnbull, jun., acknowledged by Mr. McLelland of the Steel Company of Scotland. Other toasts were "The Railway Interests," "The Visitors," "The Chairman," and "The Croupier." In the course of the evening, which was much enjoyed throughout, several of the company entertained the gathering with songs.

AWARDS TO WORKMEN FOR INVENTIONS.

IMPROVEMENTS in the machinery and methods of work in every department of industry are, in these days of keen competition and cheap patents, a very important factor in our progress as a manufacturing nation. In our large industrial establishments the workmen themselves have too seldom been instrumental in effecting such improvements, although in many respects the most fitting mediums through which improvements could come, if for no other reason than for the likelihood of success, due to the close study of results which their everyday practice enables them to make. A lingering antipathy, perhaps, to new machinery, on the score of its supplanting hand-work, and, probably, also the want of proper scientific knowledge—without which, it is often evident, practical men are so apt to attempt impossible things, or so ready to feel discouraged from striving after perfectly possible results—have been the obstacles in the way of many. To encourage the exercise of the inventive faculty amongst workmen, schemes are now in operation in several industrial establishments, which are worthy of being copied throughout the kingdom. We refer to the system of awards for inventions by workmen which was instituted by Messrs. Denny and Brothers, Shipbuilders, Dumbarton, in August, 1880, referred to in our columns at the time, and since adopted by several other firms, amongst whom are:—Messrs. J. & G. Thomson, Shipbuilders, Clydebank; Messrs. Denny & Co., Engineers, Dumbarton; Messrs. Edward Withy & Co., Shipbuilders, West Hartlepool; Messrs. The Carron Iron Works Company; and Messrs. Harrison, Carter & Co., Milling Engineers, of Mark Lane, London, and Ipswich.

The committee of independent gentlemen who act in connection with Messrs. Denny's scheme have recently issued their sixth annual report, and its circulation amongst the workmen who have taken part in the inventive work of the year must act as an incentive to renewed effort. A few particulars of the scheme, culled from this report and from already published accounts of its progress, may not be uninteresting to our readers. The scale of award with which the scheme was started consisted of sums ranging from £2 to £10, in proportion to the worth of the improvements for which claims were lodged with the committee. Fully a year later the firm announced that in the case of an invention thought worthy of a greater award than £10, they had empowered the committee to grant such an award, or were willing, in addition to giving an award of £10, to take out at their own expense provisional protection at the Patent Office, on behalf of the inventor, so that he might either dispose of his invention or complete the patent, provided always they had free use of the thing patented, in their own establishment. In a note to the report of 1883 the firm announced that they had decided to increase the maximum grant from £10 to £12, and the minimum from £2 to £3, and that in the case of two individuals being engaged at the same invention, should it be found worthy of award, each would receive at least the minimum award of £3. Later on it was intimated that "whenever any workman has received as many as five awards, reckoning from the time the scheme came in force, he shall be paid a premium of £20; when he has received as many as ten awards he shall be paid a further premium of £25; the premiums always increasing by £5 for every additional five awards received."

From the report just issued for 1885, we see that some important modifications have been made in these rules, but before entering on this, it may be advisable to give some idea of the extent to which the above offers were taken advantage of. This will be gathered at once from the following table, which gives the results for the years 1880-84 inclusive:—

	1880	1881	1882	1883	1884	TOTAL.
Claims received ..	12	32	27	20	147	238
Awards granted ..	6	22	21	18	51	118
Unsuccessful claims	4	8	7	5	69	93
Awards paid ..	£16	£62	£91	£68	£280	£517

Thus up till the end of 1884 as many as 238 claims had been received, 118 of which had been granted awards; representing in all the disbursement by the firm of about £520. During 1884 alone, the sum expended amounted to £280, of which £200 went for awards in the usual manner, and the remainder in four premiums of £20 each to workmen who had been successful in obtaining five awards during the whole period. Four inventions submitted during the period had gained the maximum award of £10, viz.:—(1) An improvement in ships' water closets and urinals; (2) the invention of a machine to cut mouldings imitative of wicker work; (3) an improved arrangement for disengaging steam and hand steering gear; (4) an improved method of laying the Decauville railway across the main line. In connection with the latter invention, the patentee of the Decauville railway system supplemented the committee's grant to the extent of £10. The returns also showed that one-half of the awards given were gained by workmen in the joiners' and carpenters' departments. Some of the machines there had been modified so as to do twice the quantity of work previously possible, some to do a new class of work, and others to do the same work with greater ease and safety.

By an arrangement made during 1884 with Messrs. Edward Withy & Co., who had adopted the system of awards as instituted in Messrs. Denny's, it was provided that if either firm desired to adopt any invention or improvement made in the yard of the other, they might do so by paying to the claimant a sum equal to that which had been awarded by the committee of the yard to which he belonged. The prospect was thus opened up of claimants receiving a double award for inventions of merit; and in at least one instance this has been realized: Messrs. Denny having duplicated an award of £3 to one of Messrs. Withy's workmen for an improved sand-papering machine.

To come now to the report for 1885:—It shows the scheme to be as vigorous, if not more so, than in previous years. During the year 134 claims were considered by the Committee, 107 of these being new claims, and 27 carried forward from 1884. Of the

total number, 57 were found worthy of award, 58 had to be rejected, 4 were withdrawn, and 15 deferred. The Committee point out that the total number of claims sent in during the year was less than in 1884, a result, however, which was fully anticipated, owing to the large reduction of men employed. The expenditure on behalf of the scheme for the year amounted to £289, being £9 more than in 1884. Of this sum, £209 were paid for ordinary awards, and £80 in premiums of £20 each. Altogether the firm has thus paid in awards and premiums since the beginning of the scheme the sum of £809, giving an average rate per award of over £3 12s. As in former years, the workmen in the joiners' and carpenters' departments received one-half of the awards made. As indicating the nature of some of the inventions and improvements for which awards have been given, we may notice at random:—"For suggestions regarding the arrangement of bunkers in ships, whereby the ballast will be reduced to a minimum, £5;" "for an adjustable clutch for holding drills in vertical boring machine, £3;" "for an appliance for holding the ratchet when boring holes in the beams or ceilings of ships, £5;" "for a new method of fitting upper cargo derricks to masts, £4;" "for a new method of pressing jalousie mouldings together while being glued, £7;" "for a new method of dovetailing hen-coop corners by machine, £4;" "for a new method of making bilge rise-boxes, £4;" "for a new method of heating water by steam, £4;" "for a new method of cutting the gutters in skylight-bearers, £5;" "for a new method of fastening jalousie mouldings by a slip feather joint, £3;" "for making alterations in Kirke's patent wood boring machine, £5;" "for a new method of cramping ship's chairs, £4;" "for a tool for punching out the rivets in the buckles of frame saws, £3;" "for a railway netting frame with spring clip, £3;" for an improvement on skylight quadrants, £3." The committee are pleased to be able to report that the ratio of the number of successful claims to the number of decisions given is higher than in 1884, being ·49 in 1885, and ·42 in 1884. They are also gratified to find, from the results of an investigation recently made into the working of the scheme from its commencement, that 97·7 per cent. of the total awards made have been for claims that have proved practically successful.

With the view of enabling the committee to give awards to claims of a character which had been previously rejected in considerable numbers, the minimum award has been reduced again to £2; but, on the other hand, the maximum award has been increased to £15, to draw out, if possible, claims of even higher merit than any hitherto received. Intimation of a change in the rule concerned with premiums has also been made, the granting of which is now based on a principle of greater fairness. The rule now reads:—"Whenever any workman has received as many as five awards from the committee, reckoning from the time the scheme came into force, he shall be paid a premium equivalent to the total amount of money paid to him for these five awards; for every succeeding five awards which he may earn, he shall be paid a similar sum, but with the addition of £5 in the case of the second set of awards, of £10 in the case of the third set of awards, and so on by sets of five." The report of the committee acting on behalf of Messrs. Denny & Co., is couched in a like encouraging strain to Messrs. Denny & Bros. The scheme in this case is almost similar, although quite distinct from Messrs. Denny & Bros. The report states that 35 claims have been considered during the year. Of this number, 10 have been successful, 18 unsuccessful, one withdrawn, and five postponed for further consideration. Three claimants received awards above the minimum, one of whom received the maximum award of £12. This claim, the committee state, deserved the maximum award most highly, the subject of it being the modification of an hydraulic rivetting machine to do a large quantity of work hitherto done by hand labour. They add, with regard to the other claims for which awards were given, that so far as yet ascertained they are nearly all proving practically useful. As indicating the nature of some of the inventions and improvements for which awards have been given during the past year, the following may be extracted from the report:—"For an improved hand-boring machine for boring holes inside of pump chambers, £3;" "for an improvement in tool used for facing cylinder chambers, £3;" "for a method of screwing threads of rods where gripped by machine by means of left-handed dies, £4;" "for a combined drill and cutter for boring and cutting holes in condenser flanges, £5;" "for fitting shear blades to smaller hydraulic rivetting machine for paring front ends of furnaces, &c., &c., £12."

The results attending the institution of the award scheme in other establishments besides those referred to above, are not as yet fully reported, but it is understood the measure of success attained has more than justified its adoption.

TRADE NOTES FROM THE TYNE, WEAR, TEES, &c.

The Tyne strike of shipbuilding operations which was referred to last month still continues to hinder progress in the northern ports, and has in many instances brought the operations of builders to a complete standstill. Several conferences between the employers and the representatives of the workmen have taken place, the result of which is that the former have reduced their claim for a reduction of 12½ per cent. off piece prices all round to 10 and 7½ per cent. respectively off the prices paid to platers and rivetters. They have also modified their demand for a reduction of the time wages to one of 2s. per week instead of 3s., which was previously asked for. The men offered to submit to reductions varying from 2½ per cent. on the lower paid jobs to 7½ per cent. on work of a more remunerative kind, but declined to acquiesce in the application of the reduced rates to repairing work, or to the proposed lowering of the time wages. This offer proved wholly unacceptable to the employers, and at the time of writing the officials of the men's society are taking steps to ascertain whether or not the men will agree to the modified terms offered them by the employers. At the Elswick shipyard (Sir W. S. Armstrong, Mitchell & Co.'s), preparations are being made for laying down another war vessel, there being already four on the stocks. A sixth building slip is being prepared, but as it is intended for the very heaviest class of vessels, a vast amount of labour must be expended on it with a view to ensure solidity before it can be utilised. Each of the three shipyards at Walker will be busier when operations are again resumed by the "ironmen" than they were at the close of last year. Messrs. W. Dobson & Co.'s yard, in particular, is well supplied with work. It is stated that Messrs. Schlesinger & Davis, of Wallsend, have got an order, and that operations will be resumed as soon as a settlement with the ironworkers is effected. The yard has been closed for more than a year. Messrs. Swan & Hunter, Wallsend, have a couple of vessels to go on with when the wages question is out of the way. Messrs. Palmer & Co. are contemplating the temporary suspension of nearly all the foremen in their large establishment, this step being necessary on account of the almost total stoppage of operations. The firm have a good deal of work, and will be able to set on a good many extra hands when the strike is closed. In connection with the other yards on the Tyne there is nothing of special interest to note. Messrs. Hawthorne, Leslie & Co., Marine Engineers, St. Peters, have, it is stated, work enough on their books to keep their place going briskly for a couple of years. At present, however, there is no particular briskness existing, the stoppage in the shipyards having caused the contracts in progress to be somewhat ahead of probable requirements. The Neptune Engine Works, Walker, continue to be well employed, the engines in progress being mostly of the triple expansion type. At the North-Eastern Works, Wallsend, business is a little better than at the end of last year, there being now four engines of average propelling power in hand. At the Wallsend Slipway Engine Works, and also at Messrs. Palmer's, operations are greatly restricted in consequence of the shipyards' stoppage. Messrs. Stephenson, McIntyre & Co. have had to resort to short time in the marine departments and fitting shops generally, but the foundry operations are kept busy on castings for locomotive work. Several orders for railway engines have lately been secured, some of them being from foreign countries, and in a short time the activity of the foundry will be transferred to the other departments. The smaller engineering establishments are affected by the conditions which impede work in the larger ones, and they are therefore, as a rule, doing little. Messrs. Chapman & Carverhill, ironfounders, Low Elswick, manage to get a large amount of heavy marine work to do, and while many other foundries are on the point of closing, their establishment is kept brisk. The forges are still almost entirely without work, and the state of work in the rolling mills has not improved since last month. The manufacture of angles, however, has been commenced at the Yarrow Steel Works, and one of the first orders to be executed is the frame material for two vessels about to be laid down in a yard on the Wear. The other steel works in the district are very fairly employed, and future prospects are good. Messrs. Hawks, Wrayshaw & Sons' chain department is pretty busy, the firm having obtained the contract for the Tyne Commissioners' requirements during the present year. Messrs. Abbot's chain shops are idle, the men being unwilling to submit to a reduction of 2d. per cwt. on the price of heavy chain, which reduction, it is stated, would have enabled the firm to secure

work for a few weeks. The firm, however, are doing well in other departments of their works, the metal pipe foundry being particularly busy. The number of laid-up steamers in the river and docks has undergone no change during the month, but the probability is that the number will be lessened as the spring advances, and navigation in the northern seas is rendered possible.

The Wear.—Despite the inauspicious state of matters in connection with the ship-building trade, a few orders are finding their way hither. Messrs. Boolds and Sharer have been commissioned to build two steel vessels of average dimensions, and the preliminary work connected with them is now being proceeded with. Messrs. R. Thompson & Sons have obtained an order for an iron sailing ship of good size, and in this case also the preliminary work has been commenced. The yard has been closed now for more than six months. There are rumours afloat respecting other orders being placed on the river, but only in the cases mentioned, is there any positive evidence of the fact. The proprietors of the Strand slipway and ship-building yard have taken an important step with a view to release themselves from the difficulty caused by the strike. They have arranged with another section of operatives, who though connected with the trade, are not participators in the strike movement to carry on the work of their establishment, and the new men have already made a start. They are commonly known as non-Union men, but in spite of that fact they have a Union which is called The Shipwrights' Ironworkers' Association. They originally served their time as wood shipwrights, but within the past few years have turned their attention to the iron work, in which department they have become quite expert. The firm have a steel vessel in course of framing, and a sailing ship will shortly be laid down. They have also a couple of large hopper barges to build. Messrs. J. L. Thompson & Sons have, during the continuance of the strike, kept the frame-bending and framing departments going uninterruptedly. One vessel's frame have been bent by the apprentices in the time, and frame bending for another has been commenced. The newly patented angle levelling machines manufactured by Messrs. Davis & Primrose of Leith are in use by the firm, and have been found a great aid to good workmanship. Tweddell's hydraulic rivetting machines have also been adopted by the firm, and are admittedly an indispensable adjunct to the very superior facilities of their yard. In the other yards no special steps have been taken to carry on work, and things are generally at a standstill. In the marine engineering works, little change has taken place in the state of affairs since last month. Messrs. Dickinson have a good many repairing jobs in hand, and they have been enabled to slightly increase the number of workmen employed. At the North-Eastern Works a few hands have also been put on. The other establishments are either wholly idle, or have next to nothing to do. Foundries and forges are still without work, except in a very few cases, and both the chain works on the river are inoperative. Although the majority of rolling mills throughout the country have only been working intermittently for some time past, the one establishment on the Wear has been kept going pretty steadily, the reason of this, no doubt, being that there is a good market for the commodity produced, on the spot. Coal shipments, both coastwise and foreign, have shown a good winter average during the month, and there have also been some heavy shipments of coke and glass bottles.

The Hartlepools.—In reference to the Hartlepool shipyards there is nothing new to state, the work in progress having been practically stopped a month ago by the turn out of the men in the plating and rivetting departments. Messrs. Richardson and Son's Marine Engine Works continue pretty brisk, and in addition to the large amount of work in hand for new vessels, the firm are now engaged in substituting triple expansion for the old surface condensing engines in a large mail steamer. The Central Marine Engine Works though better employed than many other engineering concerns on the North-East Coast, are not fully engaged as the establishment just referred to. In the docks business is dull, the period for activity in the timber trade not having yet arrived, and coal shipments being barely maintained at the customary winter average.

Stockton.—Messrs. Pearce and Co. commenced the framing of a large vessel at the beginning of the month, but the work has since been discontinued, and the machinery is now standing. Messrs. Richardson and Duck launched a sailing ship this month, and they have another on the stocks in frame. It is understood that the firm have other vessels to lay down when the wages dispute is settled. Messrs. Blair and Co., engineers, have only a moderate amount of work on hand, and the number of operatives employed is far short of the ordinary compliment. Some of the larger iron works are running full time or nearly so, but others are either closed or only in occasional operation.

Middlesbro'.—Messrs. Railton, Dixon, and Co., shipbuilders and repairers, have a sufficiency of new work in their yard to keep it busy, but there is no pressure for early delivery, and they are therefore taking matters very easy. An extensive repairing contract has been secured however, and the execution of this work will probably be pressed on with the characteristic energy of the firm. The other shipbuilding and repairing establishments at this centre are entirely without work. The Teeside Iron and Engine Works are very slack in all departments, excepting the boiler yard, where the work in hand is very considerable. One or two principal foundries are pretty fully employed, but others are having little or nothing to do. Most of the finished iron works are on short time, but the steel works show fairly sustained activity. The shipping trade of the port is as good as can be expected under present circumstances, but that is not saying much; and the time is eagerly looked forward to, when an increase of timber imports will give an additional stimulus to business.

INSTALLATION OF THE ELECTRIC LIGHT ON BOARD THE S.S. "CITY OF BOMBAY."

On the invitation of Messrs. George Smith & Sons, a large number of ladies and gentlemen visited the new screw steamer *City of Bombay* last month, when the vessel was lighted by electricity. The steamer has been fitted with the single wire system of electric lighting and the result has proved entirely satisfactory. In the exquisitely finished saloon, staterooms and music-rooms, as well as in the passages, there are altogether 50 electric lamps on beautiful silver-plated pendants and brackets; while on the deck there are five magnificent cargo lamps each of 50 candle-power, the mast and side lights consisting each of two 50 candle-power lamps. While, however, the mast and side lights consist each of two lamps only one is in operation at a time, but should that one fail, the other, by an automatic arrangement, takes its place. In the engine room circuit, including the boilers and shaft tunnel, there are 24 lamps. The electricity is generated by two Andrews' dynamos, A type, each capable of supplying 80 lamps, and there being 112 on the whole ship, the vessel, as will be seen, is furnished with considerable surplus lighting power. The light is very steady and the opal globes in the splendid saloons, cabins and passages give it a most pleasing effect upon the eye. The visitors manifested much interest in all the departments, which are characterised by magnificence, comfort and substantiality.

Messrs. J. D. F. Andrews & Co. have lately finished a complete installation on board the largest steamer of the fleet of the Bedouin Steamship Company, Liverpool. The lights are dispersed throughout the whole of the ship, including 50 candle-power lamps in the masthead, stern and side lights. The installation consists of about 100 glow lamps and the electricity is supplied by one of Andrews' slow speed dynamos driven by a Tangye engine. They have also been allotted the lighting of a large portion of the International Exhibition to be held in Edinburgh in the coming season. The space allotted to them will be lighted with 34 Andrews' arc lamps, supplied with current from two Andrews' patent dynamo machines. One powerful Andrews' arc lamp will also be erected on a mast 80 ft. high in the courtyard of Old Edinboro'. The other lights will be distributed throughout the machinery and motion departments of the Exhibition.

The Atlantic Service.—Messrs. John F. Allen & Co., of Fenchurch-street, agents for the Anchor Line of United States mail steamers, intimate that a fortnightly express service has been arranged, with sailings from Liverpool and from New York, every alternate Wednesday. This service will be performed by their steamer *City of Rome*, in conjunction with the steamship *America* (National Line), and is to begin on the 31st of March.

CLYDE INDUSTRIAL NOTES.

SEVERAL gratifying facts fall to be reported this month with reference to orders for new work received by shipbuilders and engineers on the Clyde. The most noteworthy, perhaps, is the announcement that negotiations which have been going on for some time past between the Orient Company and the Fairfield Shipbuilding and Engineering Company for a large steel screw steamer, have resulted in the order being placed with the latter firm. The vessel in question is to be over 6,000 tons gross register, being 480 ft. in length, 52 ft. broad, and 37 ft. deep. She will have accommodation for 316 first and second class passengers, and 500 steerage passengers, and the luxuriant furnishings with which she will be provided gives promise of employment to a large number of joiners, cabinet makers, and upholsterers, who are at present out of employment. The steamer will be fitted with triple expansion engines, embracing all the latest improvements, and to indicate 8,000 H.P. Steam will be provided by six steel boilers, fired from both ends, and having six furnaces each. The working pressure will be 150 lbs. to the square inch. The booking of this fresh order brings the amount of the work presently on hand in the Fairfield Works up to about 24,000 tons—a very respectable total in times like the present.

Messrs. R. Napier & Sons, who have at present a large amount of work on hand, all Government contracts, have very recently contracted with the Russian Government to construct three sets of twin-screw triple expansion engines capable of indicating 2,000 H.P. each. These will be constructed on the triple expansion principle introduced by Mr. A. C. Kirk, the managing partner of the firm, and will be fitted with all the most modern improvements. This order may be regarded as a further indication of the high position which the firm now holds in the estimation, not only of the British Government, but of the other great nations of the world. In addition to the contract now secured Messrs. Napier are presently building for the Russian Government a set of twin-screw triple expansion engines of 13,000 I.H.P.—amongst the most powerful engines known. For the two belted cruisers, the *Australia* and *Galatea*, building in this shipyard for the British Admiralty, Messrs. Napier & Sons are constructing two sets of twin-screw triple expansion engines, each of 8,500 H.P. The Messrs. Napier are now in the fortunate position of having their engine and boiler works, like their shipyard, fully occupied—a state of matters which at the present time is almost exceptional. The booking of this contract, together with that of the Orient line by the Fairfield Company, means a substantial reduction in the hosts of unemployed artizans now hanging idly about the streets of Govan.

Amongst other less important orders booked during February, reference may be made to those received by Messrs. McKnight and Co., of Campbeltown, and Blackwood & Gordon, of Port Glasgow, for new Clyde river steamers; by Messrs. D. J. Dunlop and Co., Port Glasgow, for a tug steamer to be employed on the Thames; and by Messrs. Denny & Co., Dumbarton, for two additional eight-draft craft for river service in India. The first named order is for a new paddle steamer to be employed in the Kilcreggan and Kilmun service and owned by Captain Campbell, who already owns the *Meg Merrilees* and the *Waverley*. The new vessel will be 190 ft. long over all, 20 ft. broad, and 7 ft. 2 in. deep. The machinery will be supplied by Messrs. Hutson and Corbet, of Kelvinhaugh Engine Works, and will comprise steel boiler of the "hay-stack" type, 13 ft. diameter and about 13 ft. 6 in. high, having four furnaces, and worked at a pressure of 55 lbs. per square inch, engines of diagonal surface-condensing type having 46 in. cylinder and 5 ft. 6 in. stroke. The speed will be about 18 knots, and it is intended that the vessel will be ready for service in June next. The paddle steamer ordered from Messrs. Blackwood & Gordon, Port Glasgow, is for Captain Campbell, of Wemyss Bay, for service between that port and the coast watering places. She is to be 225 ft. in length, 23 ft. broad, and 8 ft. depth of hold, and to have saloons and promenade deck all fore and aft. She will be fitted with diagonal surface-condensing engines of 160 N.H.P., supplied with steam from two large upright boilers. The vessel is to attain a high rate of speed and is expected to be ready for service in June next.

The ranks of the unemployed are here and there being reduced, but destitution still prevails, and the various organisations for relieving the distress in the several districts are more than ever run upon. More than three times the amount of work presently on hand would be required to obviate the necessity for tendering help to the unemployed. Such a state of matters as is here hinted at will, it is feared, exist for many months to come, and it is believed by some that the period may be marked by years rather than months. The measure of activity which does obtain at present on the Clyde is happily unbroken by any wages disputes such as are disturbing the industrial establishments in other shipbuilding and engineering centres.

Attention may be drawn to the unusual activity prevailing at present in a small but very important department of the shipyards on the Clyde, in view of the several exhibitions to be held throughout the kingdom during the present year. This is the modelling department, where miniature representations of the actual vessels are produced, either for purposes of design and construction, or for representing in the fullest possible detail the actual vessels, as turned out of the hands of the builders. It is with the latter object in view that almost all the important firms on the river have their modellers actively employed at present in producing full-rigged and half-block representations of their most noteworthy ships, destined either for the great Maritime Exhibition at Liverpool, the International at Edinburgh, or the Colonial in the Metropolis. Many of these models, as already seen in exhibitions during the past few years, are genuine works of art, and doubtless possess, besides this educative value to those practically concerned, great interest for the general public. Their presence in such profusion must have a reassuring effect on all who may be disposed to think that machinery has driven handicraft out of existence, and that the present day utilitarianism has banished from our workshop the artistic taste and personal pride in hand-made work which "once-upon-a-time" prevailed. The *Servia*, *City of Rome*, *City of Berlin*, *Alaska* and *Livadia*, are some of the more celebrated vessels which have been represented in miniature at former exhibitions, while several others, such as the *Oregon*, *Belgravia*, and *Etruria* have been similarly portrayed and presented to their owners. Apart from their intrinsic worth as works of art, these models have a value as a medium of advertisement, which may be partly guessed at, from the fact that in many cases their production costs from between £200 and £300; while, in the case of one of those above named, as much as £500 has been refused as an offer of purchase. An elaborately fitted full model of the North German Lloyd vessel launched the other day from Fairfield works is being made there; several models of Anchor line steamships are being completed by Messrs. D. & W. Henderson, of Partick; the *Archer* type of Government cruisers is being illustrated in the same way by Messrs. Thomson, Clydebank; the London & Glasgow Shipbuilding Company are reproducing some of their large ships in miniature form, and Messrs. Denny and Messrs. McMillan are preparing highly-finished models of some of their crack vessels, in addition to those already made and shown at previous exhibitions.

Amongst examples of this kind of art which will find a place in the Edinburgh International Exhibition will be one more than usually noteworthy, representing a Dumbarton-built steamer for the British India Steam Navigation Company. This is an elaborate sectional model, constructed of metal, representing the vessel, which is 340 ft. by 42 ft. by 29 ft., on a half-inch scale, or 1-24th the actual size. It exhibits the vessel as if shown completely up the mid-line from stem to stern, and revealing all the internal work both with respect to structure and outfit. The model, which is the work of mechanics attached to the Science and Art Museum in Edinburgh, and has been several years under way, is constructed in a manner which corresponds exactly, as regards the arrangement of the structural parts, to the construction of the actual vessel, except that the parts, which consist of very thin sheet iron, are bound with solder instead of rivets. Thus, the deck plating, shell plating, and framework of hull, are represented in all the detail of out and in strokes of plating, butt-straps, main and reverse frame angles, beam angles, &c.; and inside of these, just as in the actual vessel, are the wood ceiling and sparring, pillars, masts, deckhouses, deck fittings, stateroom framing, sidelights, &c. The whole is rendered with marvellous fidelity, and the impression of realism and fullness is further enforced by the presence of the propelling machinery, engines, boilers, steam pipes, shafting, propeller, and smaller details, much of the work being shown in section, and all proportionate. All the work, except a few items of deck machinery, such as steam winches and windlass, has been done in the workshop attached to the Museum from sketches supplied by the builders of the original vessel, and it is an eloquent testimony to the intelligence, neat-handedness, and painstaking skill of the museum mechanics. The winches, windlass, &c., which are of brass, are from the model-making works of Kelso & Co., 2, Commerce-street, late of Union-street, Glasgow, well-known for the accuracy and neatness with which they finish work of this delicate kind.

Reviews.

Chain Cables and Chains. By Thomas W. Traill, C.E.R.N., Engineer Surveyor-in-Chief Board of Trade, etc. London: Crosby Lockwood & Co.

NEVER before have we seen the subject of chains so thoroughly, comprehensively, and yet so lucidly gone into as in the work now before us.

We must, at the outset, confess to a feeling of pleasant surprise at the eminently interesting, and even entertaining manner in which the author has dealt with his subject, for from such an acknowledged master, and one so well versed in the art, we fully, and almost naturally, expected, and would readily have forgiven, a more severely technical and, from the reader's point of view, a correspondingly "dry" rendering of it. The very ample and complete manner in which all that appertains to cables and chains has been dealt with is, perhaps, best indicated by a perusal of the full title, which, briefly setting forth the contents of the work, reads as follows:—"Chain Cables and Chains; comprising sizes and curves of links, studs, etc., iron for cables and chains, chain cable and chain making, forming and welding links, strength of cables and chains, certificates for cables, marking cables, prices of chain cables and chains, historical notes, acts of parliament, statutory tests, charges for testing, list of manufacturers of cables, etc., etc."

Under these various headings, and by the aid of numerous tables, illustrations, and lithographic drawings (every one of which is executed in the best possible style), the author has placed the reader in possession of the fullest and most recent information it is possible to obtain, and that in a pleasant and readable manner, shorn of all unnecessary professionalism, if we may use the word.

As showing the important part that chain cables take as an article of manufacture, it may not be without interest to our readers to quote as follows:—"Since the Act of 1871, which came into operation in the early part of 1873, until the latter part of 1883, a period of about eleven years, about 165,000 tons of chain have been certified to be in accordance with the Act of Parliament, as having duly withstood the statutory tests, representing about 3,190,000 fathoms of chain, and for which it is computed that from about 2,250,000 to about 2,500,000 pounds sterling have been paid."

With the above before us, it will now be interesting to note the state of the chain trade over 250 years ago, as seen from the following quotation:—"In the year 1634 a patent was obtained by Phillip White, a blacksmith, for mooring chains, it being the first published patent for chains. It was granted for a period of 14 years, a sum of five pounds of lawful English money being required to be paid in yearly at the exchequer . . . . by even and equal portions."

The story of the slow and almost torturous adoption of iron cables in place of hempen ones is well and graphically told, and serves, were it necessary, as one more example to show how ever ready prejudice is to place a stumbling block in the path of all true advancement.

We must content ourselves with one more quotation from this most interesting volume, and we heartily commend it to all shipowners as being well worthy of their consideration. Speaking of Henry Pershouse Parkes, in 1840, overcoming the difficulties attendant upon the production of larger cables, the author says of him, "His heart and soul were in his business, and the greatest difficulty he had to combat was the general desire to get cheap cables. Nothing was more astonishing to him than to see a ship well built, well found, and with everything first class, but the cables, which some purchasers were content to have, of as inferior a quality as he or others would consent to make. He had a mind above shoddy cables, and probably lost many orders because he would not make a cable to suit the price." Would that all our chain makers of to-day were more nearly prototypes of Parkes.

A series of tables of dimensions, calculated in each case to the second place of decimals, and also to the thirty-second part of an inch, of common links, enlarged links and end links, for both stud link, and short or unstudded link chain cables, together with the dimensions of their joining shackles, and end or anchor shackles, gives all the information possible on these important subjects, and is admirably aided by an elaborate and complete set of full-size drawings, many of which are coloured. Another equally valuable series of coloured drawings serve to forcibly illustrate the badly formed links, which, endangering the safety of the whole cable, as they do, are, unfortunately, only too frequently found. The same drawings also give examples of the very light and very heavy studs as they are often found. The various Acts of Parliament, together with the order in council, and the schedules, relating to the public testing of chains and cables, are given *in extenso*.

A list of the chain cable manufacturers embraces upwards of thirty of our best known firms, and in addition to enumerating their various products, gives, in each case, a short and synoptical retrospect of the firms' establishment and its members. A splendidly produced series of *fac simile* copies of the certificates issued by the different public proving establishments, each one of which is printed in its correct colour, and accompanied by a sheet showing a full-sized stud link bearing the full markings appropriate to the particular establishment at which it was proved, add greatly to the value of a work, which, even without them would, and we think we have said sufficient to show this, be unique in its production.

We cannot close our review of such a work without giving out a word of well earned praise to both publishers and printers alike, for seldom does it fall to our lot to have to handle so well and substantially got up a volume. If good, thick toned paper, bold, clear and neat printing, combined with the best efforts of the lithographer and bookbinder, can raise a volume from the ordinary level, then, indeed, may the one now before us be almost regarded as an *edition de luxe*.

Marine Propellers. By Sydney W. Barnaby, M.I.N.A., &c. London: E. & F. N. Spon.

THE book is a reprint of three lectures originally prepared for the students of the Royal Naval College, preceded by a short, but comprehensive introduction from the pen of the late Director of Naval Construction, Sir Nathaniel Barnaby.

We quite agree with Sir Nathaniel in his opening statement that the screw propeller receives, in the principles governing its proper designing, less attention, comparatively speaking, than any other part of a ship, nor are the reasons for this far to seek, for the shipbuilder looks upon it as part of the engine, and takes no trouble to study it or experiment with it; while, on the other hand, the marine engineer looks only for the greatest development of I.H.P., and as he is not responsible for the speed of the ship, only too often fits her with a propeller which is but ill-suited to give her the best speed results.

As an instance of this the writer of the introduction refers to the trials of H.M.S. *Iris*, where it was conclusively proved that two knots of speed were being absolutely lost through badly-proportioned propellers, and we are of opinion that marine engine builders generally would profit by a knowledge of the curves given in this work, by which the diameter, pitch, and number of revolutions of a screw suitable for any H.P., and any speed may be determined. These curves would alone constitute a valuable addition to any engineer's library.

We are pleased to see the screw turbine, designed by Mr. Thornycroft, has received from the author that share of attention which it so richly deserves.

Though we do not, for obvious reasons, but chiefly on the score of additional complexity, agree with the author in his advocacy of several smaller propellers, instead of one large one, as a means of enabling the engines to be run at high speed, and so kept of an aggregate light weight; yet we are fully with him when he broadly puts it that "the engines exist only to drive the propeller, and should be subordinated to it," and we cordially wish that this were made the rule, instead of being, as it usually is, the exception.

The author, while going thoroughly into the subject, has, by avoiding all unnecessary technicalities, succeeded in producing a book which cannot fail to become popular.

Inventions, and how to Patent them. A Practical Guide to Patentees By T. Eustace Smith. London: W. H. Kelly.

THIS useful little manual is essentially what its title professes it to be, namely, a *Practical Guide* for those inventors who may be desirous of dispensing with the services of a patent agent. As the author informs us in the first lines of his preface, that when calling, presumably with a view to business, upon a well-known publisher he was told "there are too many books on patents already—their name is legion," we naturally expected to find something different in this book from those that have previously come under our notice.

In this expectation we were not disappointed, for the book, though written by a barrister, shows throughout a desire to place the inventor in full possession of such information as will be of

actual and practical service, rather than to overburden him with the laws' technicalities which in many cases are absolutely without interest and only too frequently quite incomprehensible to him. In adopting, as he has done, a middle course between the big, learned books written by barristers for members of their profession and patent agents (and in which, unfortunately, in the majority of cases the inventor's interest seems to be the last thing studied) and the host of smaller books issued, as advertisements, by the various patent agents, the author has acted in a manner which cannot fail to be not only of interest but also of real benefit to all inventors. As the book is from cover to cover, full of useful information we can cordially, and without hesitation, recommend it to all our friends who are of an inventive turn and likely to become patentee.

LIST OF VESSELS LAUNCHED ON THE CONTINENT IN 1885.

(*Continued from page* 303.)

SWEDEN.

By The Motala Mekaniska Werkstads A.B.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Norra Finland ..	Bes. Steel	Steam	Swedish	589	440
Trafik	,,	,,	,,	228	190
Södermanland ..	,,	,,	,,	180	130
Ellen	,,	,,	,,	40	100
Ceres	,,	,,	,,	257	232
Pallas	,,	,,	,,	257	232
Bylgia	,,	,,	,,	26	45
Kaspii	,,	,,	S Peters-burg	25	61
Cyclop	,,	,,	Rigaer B Comite	166	73
Agnes	,,	,,	Swedish	491	250
Belas	,,	,,	,,	361	588
Æolus	,,	,,	,,	625	1,065
Lysekil	,,	,,	,,	210	500
Sviet	,,	,,	Russ. S. N&T Co.	1,827	1,095

GERMAN.

By The Stettiner Maschinenbau, Bredon, Stettin.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Obdenburg	Steel	Steam	German	—	—
Vrönig Chrissian ..	,,	,,	,,	399	170
Vraifer Wilhelm ..	,,	,,	,,	399	170
6 Torpedo Boats ..	,,	,,	,,	805	—
Prozeworski	,,	,,	,,	405	30
Vrainerun	,,	,,	,,	20	10
Sepetiba	,,	,,	Brazil	96	45
——	,,	,,	German	155	10
Gertrud Woerman ..	,,	,,	,,	1731	130

ERRATUM.

In our last number we gave the returns of shipbuilding on the North-East Coast in 1884-5, and in the table inadvertently left out the returns of the Tyne Iron Shipbuilding Company, Limited, which will be found below.

Tyne Iron Shipbuilding Company, Limited.

During 1884—		
5 iron screw steamers	..	9397 tons.
During 1885—		
1 iron screw steamer	..	1895 tons.
2 steel ,, ,,	..	1676 ,,
3 screw steamers ..	..	3571 tons.

THE UNARMOURED CRUISER "PATAGONIA."

We give in this number a two-page illustration of the steel unarmoured cruiser *Patagonia*, built for the Argentine Government by the Stabilimento Teenico Triestino, St. Rocco, near Trieste.

The length of the vessel over all is 224 ft.; extreme breadth, 33 ft. 7 inches; displacement at load line, 1,532 tons; draught of water, 13 ft.

She is engined by the same firm with two pair of horizontal direct-acting compound engines of 2,400 I.H.P. collectively, to be worked up by forced draught to over 3,000 I.H.P. A speed of not less than 14 knots to be obtained with natural draught.

She has six steel boilers of the Admiralty type.

The armament consists of one 10-in., $27\frac{1}{2}$-ton Armstrong breech-loading gun forward, commanding an angle of 260°; two 6-in. 4-ton Armstrong breech-loading guns, upon projecting platforms on the vessel's side, commanding 180°; one 6-in. 5-ton breech-loading gun (Armstrong) aft, commanding 270°. Upon the light upper structure are placed four 1-ton $3\frac{1}{2}$ in. Armstrong guns (20 pounders), and at the angles four Nordenfeldt machine guns, besides four Gardners in the bulwarks, and two in the tops. The vessel is built of mild steel, and has a $1\frac{1}{4}$ steel turtle-shaped deck below the water-line, throughout the whole length. She is divided into 70 water-tight compartments, five of them form the boiler rooms and two the engine rooms.

An exceptional large pumping power is provided.

The coal bunkers will contain about 260 tons.

The vessel is wood and copper sheeted, and rigged as a brig. She carries two steam launches and five other boats.

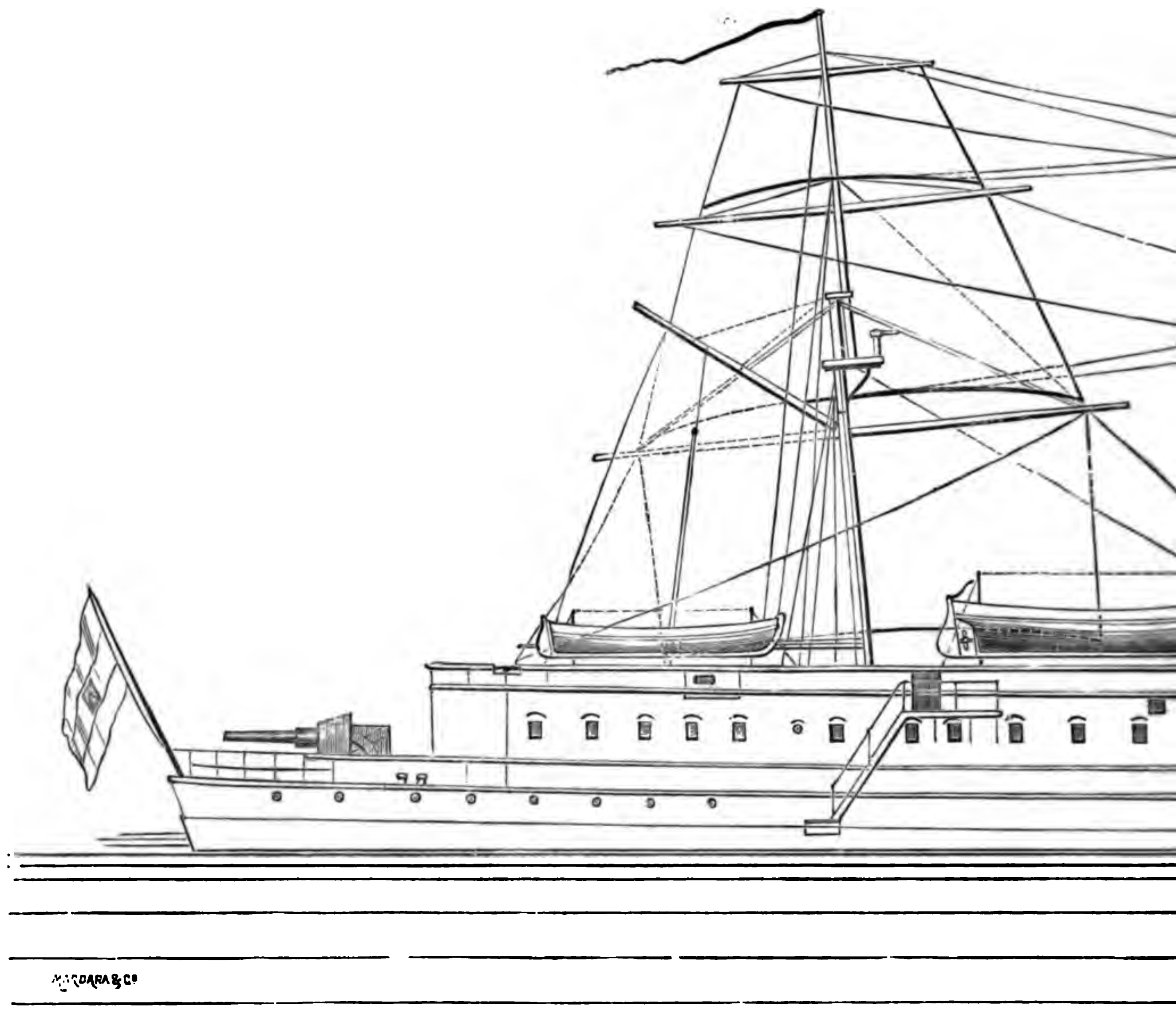
She has about 20 separate engines, comprising the main engines, donkey engines, circulating and fan engines, steam windlass, steam steering, hydraulic and electric lighting engines, &c.

There is good accommodation for 140 officers and men.

The vessel was designed by Mr. Theodore Schunk, Naval Architect of the Stabilimento, and the engines by Mr. Moliere. The construction of the vessel has been carried on under the direction of Mr. P. Paulino, and on the part of the Argentine Government by Captain C. Urtubey, naval attaché, assisted by Mr. T. W. R. Hughes, inspecting engineer.

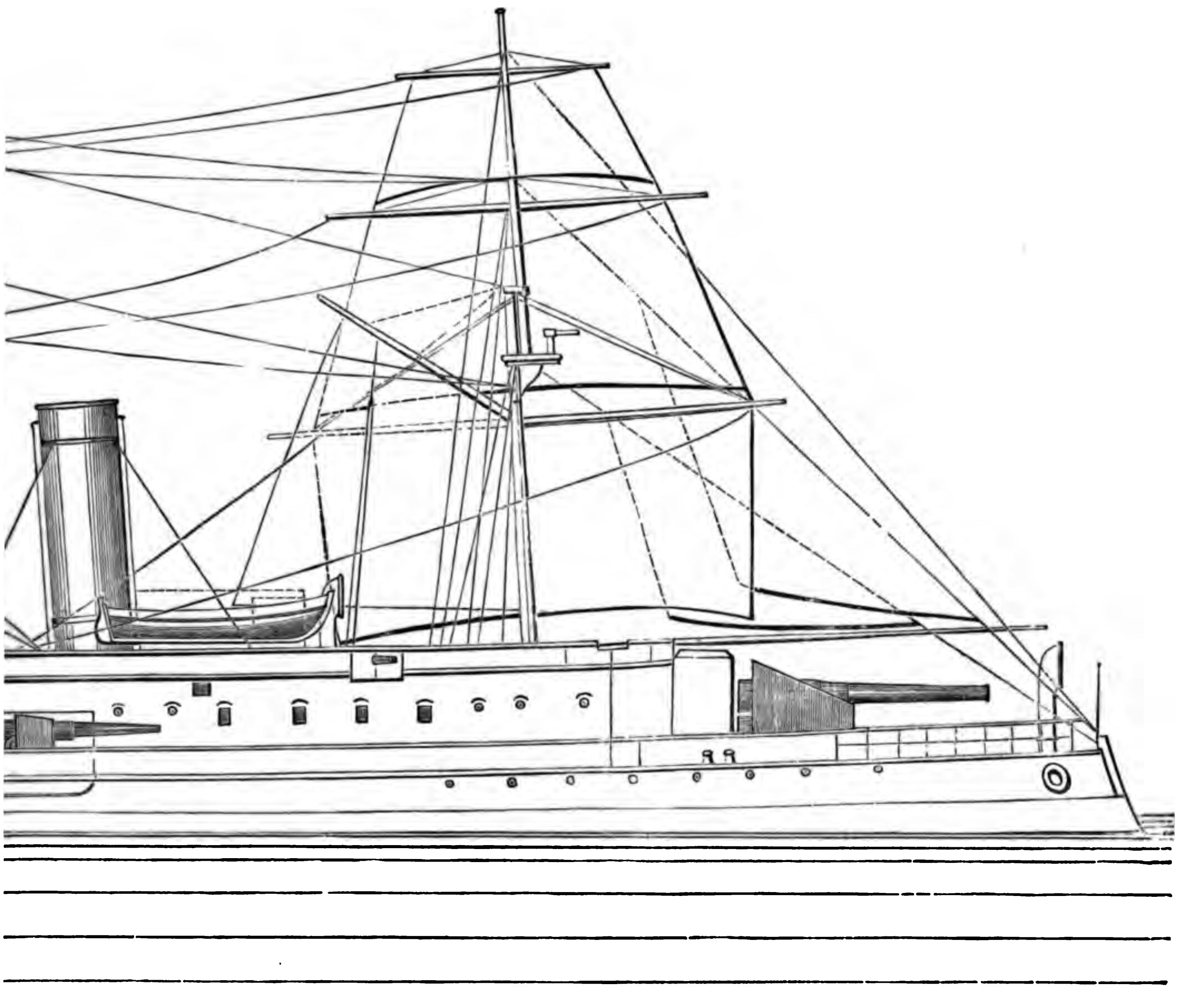
Accident to a Torpedo boat.—A singular and wholly unexpected mishap occurred at Portsmouth on January 12, to the new sea-going torpedo boat recently received from Messrs. Thornycroft. She had made a satisfactory speed trial, during which 21 knots had been realised; but while going astern, her rudder succumbed under the great water pressure so as to bring its edge against the propeller. The engines were at once stopped, and the boat was towed into harbour. When these delicately constructed craft are driven at full power, the strain upon the rudder in circling or going about is very great, and in some the rudder has been duplicated.

The *Times* says that the Admiralty authorities, considering that the torpedo boats lately completed for the Austrian Government by Messrs. Yarrow & Co., Poplar, represent a notable advance in the construction of vessels of the class, lately ordered a special report to be made of their performances. The practical result of this has been that Messrs. Yarrow have received instructions to immediately put in hand and to finish with all despatch a similar boat for Her Majesty's Navy, but subject to several important improvements.



ARGENTINE CR

(For De



R "PATAGONIA."

17.)

TRIAL UNDER STEAM, AT THE WORKS, OF TRIPLE-EXPANSION ENGINES.

THROUGH the courtesy of G. H. Baines, Esq., Secretary to the Central Marine Engineering Company, Hartlepool, we had the pleasure of witnessing a somewhat novel experiment, viz., the trial under steam, in the works, of a set of their triple-expansion engines. The trial took place in the erecting shop, the engine standing on the "erecting table," a perfectly level and rigid floor on which the bed-plate is placed after being planed on the under side; the main bearings are here bored out and the whole engine erected and finished, and in this case actually "steamed," before it is moved again. The trial was a very satisfactory one, the engines working with great regularity and smoothness at as slow a rate as 15 revolutions per minute, and stopping and reversing in a remarkably short time. They were easily controlled by one man. There are several points of interest in these engines; for example, they are as short and compact as most "compound engines" of equal power; they have few working parts, being fitted with a very simple dynamic valve gear, and have only four main bearings; there are no slide valves, equilibrium piston valves being used for each engine; the crank shaft, which runs in main-bearings of great length and wearing surface, is built and is in three separate interchangeable sections; the crank-pins are hollow steel forgings of more than ordinary length and surface; the bed-plate which, with the bottom half of the condenser, is in one casting, being perfectly flat on the underside is supported by the "engine seating" directly under the crank shaft; the connecting rods are of great length, being nearly five cranks between the centres; all the working parts are very accessible for overhauling; the engine, in all its details, is well designed and well finished, and if the results in actual working are what we are led to expect by this inspection, it will be a credit to the manager, T. Mudd, Esq., and to all concerned. We hope shortly to have the pleasure of fully illustrating and describing these engines, when we will be better able to point out their most interesting features. We also noticed some exceptionally neat and compact "compound engines" in course of construction and are informed that the firm, although not brisk, have a few orders in hand.

EARLE'S TRIPLE-EXPANSION ENGINES.

WE give this month a few drawings of a triple-expansion engine of 250 N.H.P., constructed by the Earle's Shipbuilding and Engineering Company, Limited, Hull.

This firm, which has taken a somewhat leading position in the introduction of triple-expansion and high-pressures, has adopted the simplest arrangement of the cylinders, *i.e.*, the high-pressure is forward, the intermediate-pressure occupies the middle position, while the low-pressure is aft, so that the steam has the least distance to travel from one cylinder to the next one requiring it in the order of expansion. The steam chests are placed on the same centre line as the cylinders. Messrs. Earle also adopt the common "link" and double eccentric valve gear, so that their triple engine only differs in construction from their two-cylinder compound by there being three engines instead of two. The construction of these engines may be briefly described as follows:—A strong cast-iron foundation plate contains the six main bearings, and spaces for cranks and eccentrics, and has planed faces to receive the feet of the three front columns; on the back or port side of this foundation-plate, there are several planed faces to which are bolted similar planed faces on the front of the condenser; the condenser, which is of the usual horizontal type, has feet cast on it for the three back columns, and also bases for the air and circulating pumps, and bearings for the pump levers. The cylinders are supported by six substantial cast-iron columns, three of which rest on the foundation plate at the front, and three on the condenser at the back, as mentioned above.

The diameters of cylinders are H.P. 23 in., I.P. 35 in., and L.P. 60 in., and the stroke in this instance is 4 ft. 9 in.; this latter, however, is more than the usual practice of the firm, being made to suit the owners. There are no steam jackets supplied with steam from the boilers, but the steam after leaving the H.P. cylinder, passes round it on its way to the I.P., and again after leaving the latter, passes round it on its way to the L.P. The H.P. has a piston valve, the I.P. and L.P. have each ordinary flat slide valves, and are each fitted with a balance cylinder and piston placed on the top of the steam chests, very materially reducing the work of the valve-gear.

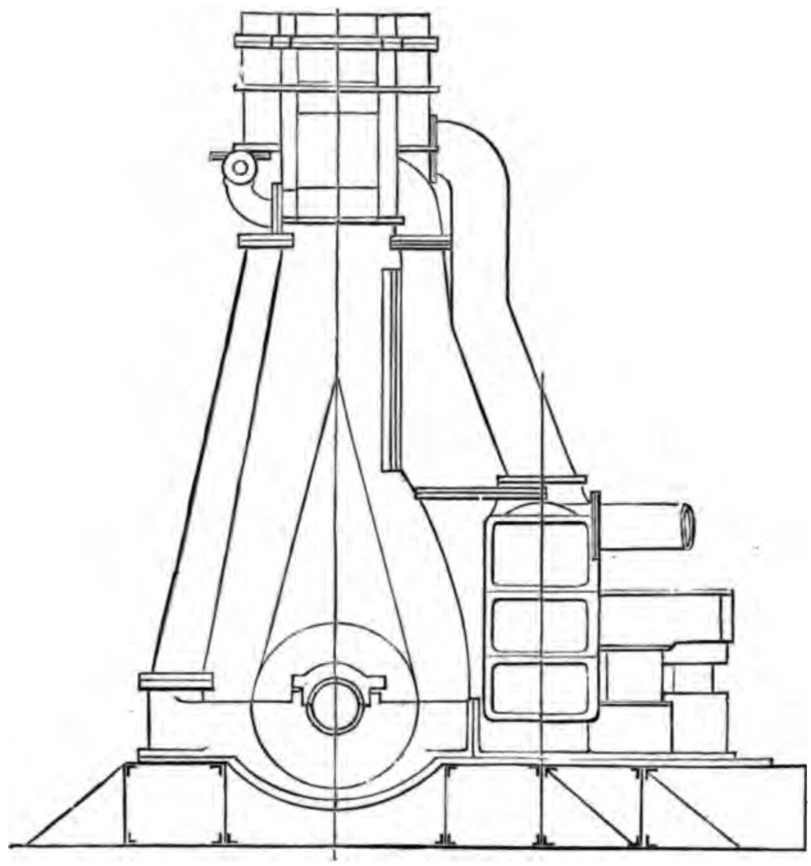
The piston-rods are of steel, and their glands are screwed up by means of a wheel and pinions. The connecting rods are of wrought-iron, and their length from centre to centre is 2¼ times the stroke of piston. The crank shaft is made in three duplicate built cranks, set at angles of 120 degrees; the crank pins are of steel, the rest of the crank shaft being of wrought iron; it is a very substantial, well proportioned shaft. The pumps are placed together behind the condenser and attached to it; they are all on one centre line, and are worked by one straight crosshead; the advantages of this is obvious, no arms or other additions being needed, thus avoiding all twisting strains. The diameter of the air pump is 20 in., that of the circulating pump 13 in., and the feed pumps are 3¼ in. diameter; the stroke of all the pumps being 2 ft. 8 in.

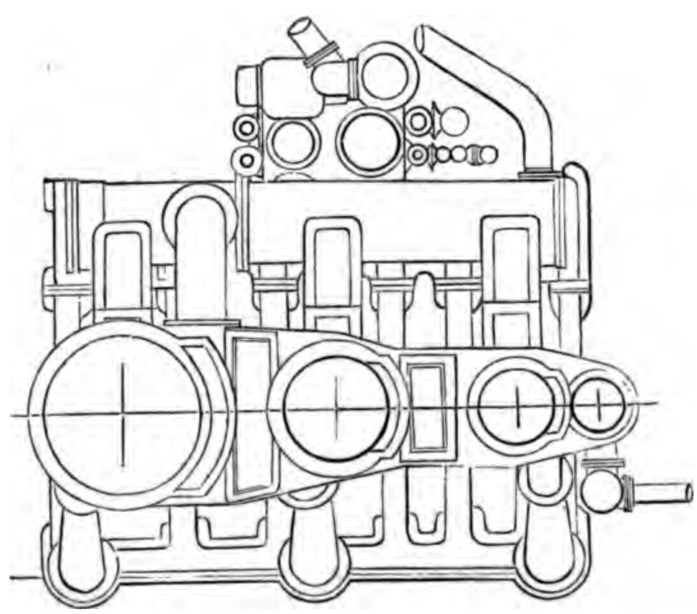
They are worked by levers from the intermediate engine. Starting, stopping, and reversing, are effected by a reversing engine of the "all-round" type, having a simple cylinder and single eccentric, connected direct to the same shaft on which the reversing wheel is placed. This reversing engine is also arranged to work the turning gear by means of a leather belt.

Steam is supplied at 150 lbs. pressure by two steel boilers, of the ordinary "marine" type, fired at each end, and having each four of Foxe's patent corrugated steel furnaces, 3 ft. mean diameter. The length of the boilers is 18 ft., and the diameter 11 ft. 2 in. The total heating surface is 1,685 square ft., the working pressure, as before stated, is 150 lbs, and the test pressure 300 lbs. The shell of each boiler is made in only three courses of plates. As will be seen by the tracings, the boilers are placed athwartships.

The consumption is from 1·5 lb. to 1·6 lb. per I.H.P. per hour. The total I.H.P. is 1,527·06 lbs.

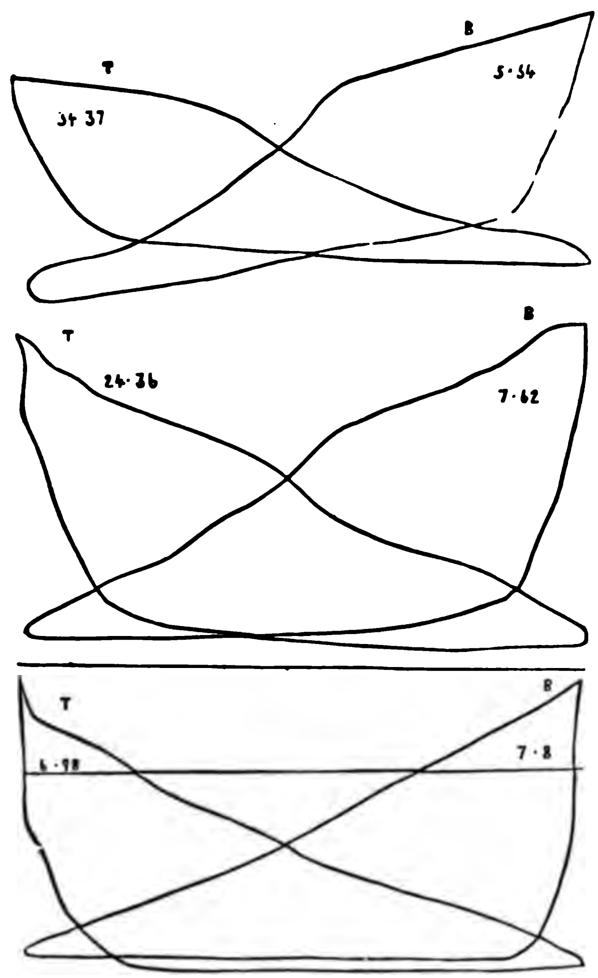
Messrs. Earle have kindly supplied us with a few cards from these engines, which will enable our readers to form a good idea of their working, and the power developed at various degrees of expansion.





EARLE'S TRIPLE EXPANSION ENGINES.

(*For description see* p. 320.)

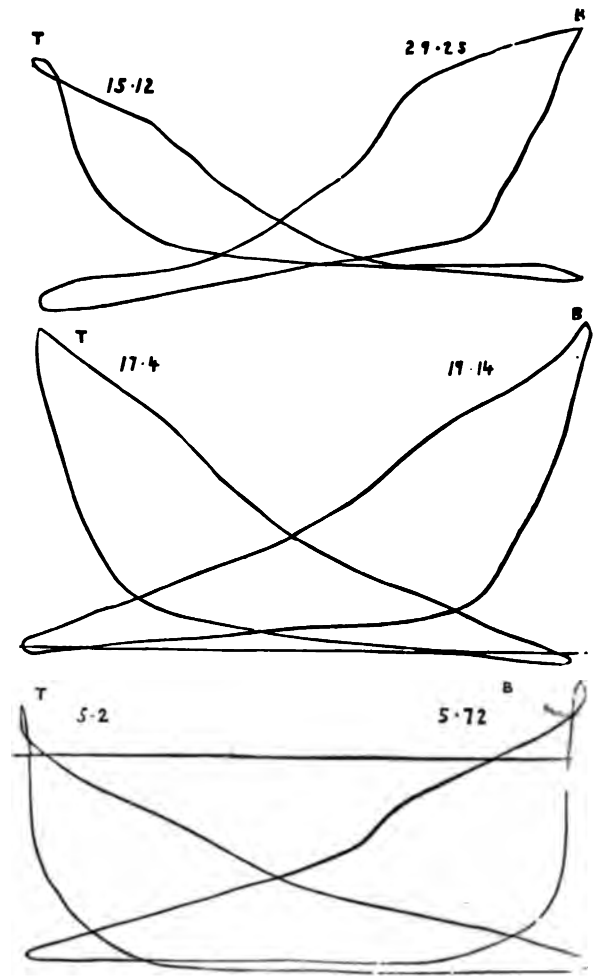


The following relates to the above sets :—

NOTCHED TWO TURNS UP OF REVERSING WHEEL.

	I.H.P.
H.P.	297·94
M.P	452·54
L.P.	384·96
Total ...	1135·44
M.P.	38.93
"	25·53
"	7·39
Steam	148
Vacuum	25½
Revolutions	64

A "SUN-AND-PLANET" engine, designed by James Watt, has still a place in the famous brewery of Messrs. Whitbread & Co. in Chiswell-street, and it is still performing the duty for which it was constructed in 1785. The *City Press* says :—"Though there have been alterations to increase its power, all the principal parts remain as they were originally manufactured. A metal tablet affixed to the engine gives an account of its invention and history."

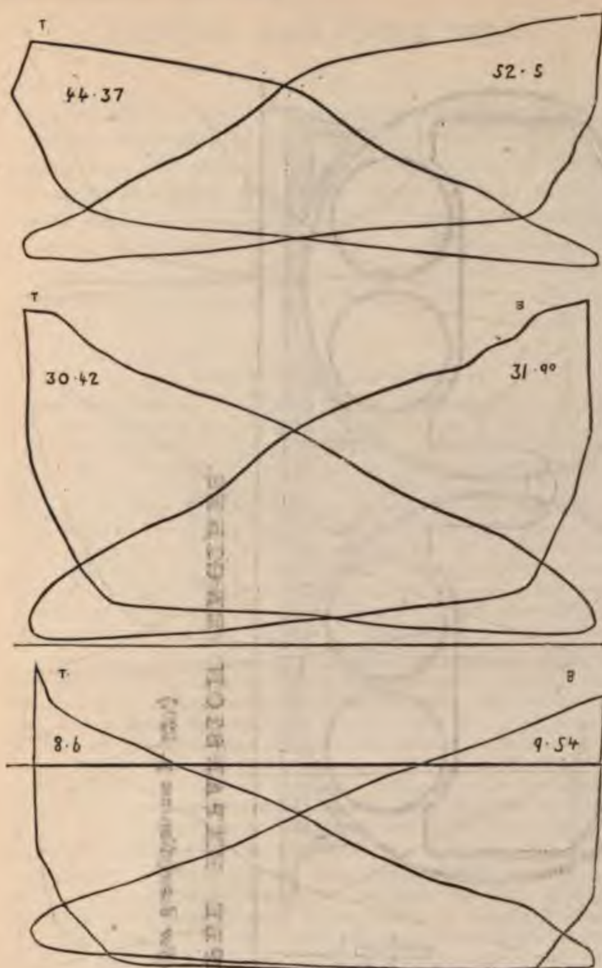


The following relates to the above sets :—

NOTCHED FOUR TURNS UP OF REVERSING WHEEL.

	I.H.P.
H.P.	145·88
M.P.	278·31
L.P.	244·42
Total ...	668·61
M.P.	22·18
"	18·27
"	5·46
Steam	150
Vacuum...	26¾
Revolutions	55

OUR Plymouth correspondent states that it is very probable that experiments will shortly be made for the purpose of ascertaining whether gas can be used for illuminating small vessels of the Navy that are not at present fitted with the electric light. It is asserted by the promoters of the scheme that a sufficient amount can be stored on board the ships without materially interfering with their general stowage.



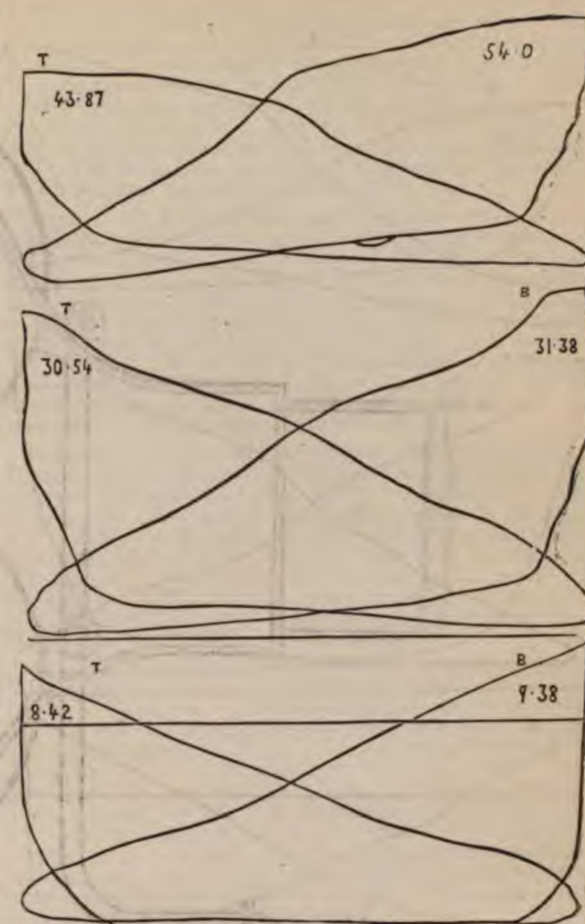
Taken from Earle's Triple Expansion Engines of the s.s. "Ariel."

The following figures relate to the above sets :—

FULL POWER, I.H.P.

H.P.	...	...	...	...	...	405·40
M.P.	...	...	...	...	...	604·89
L.P.	...	...	...	...	...	516·77
				Total	...	1,527·06
M.P.	...	...	...	...	...	48·43
"	...	...	...	...	...	31· 2
"	...	...	...	...	...	9·07
Steam	...	...	...	...	...	148
Vacuum ...	...	...	...	...	...	26
Revolutions	...	...	...	...	...	70

A LARGE dredger sank last month in Dieppe Harbour, obstructing the traffic. She is to be blown up by dynamite, but the operation will be a difficult one, owing to a fear of undermining the pier. The Newhaven steamers have had to go to Havre.

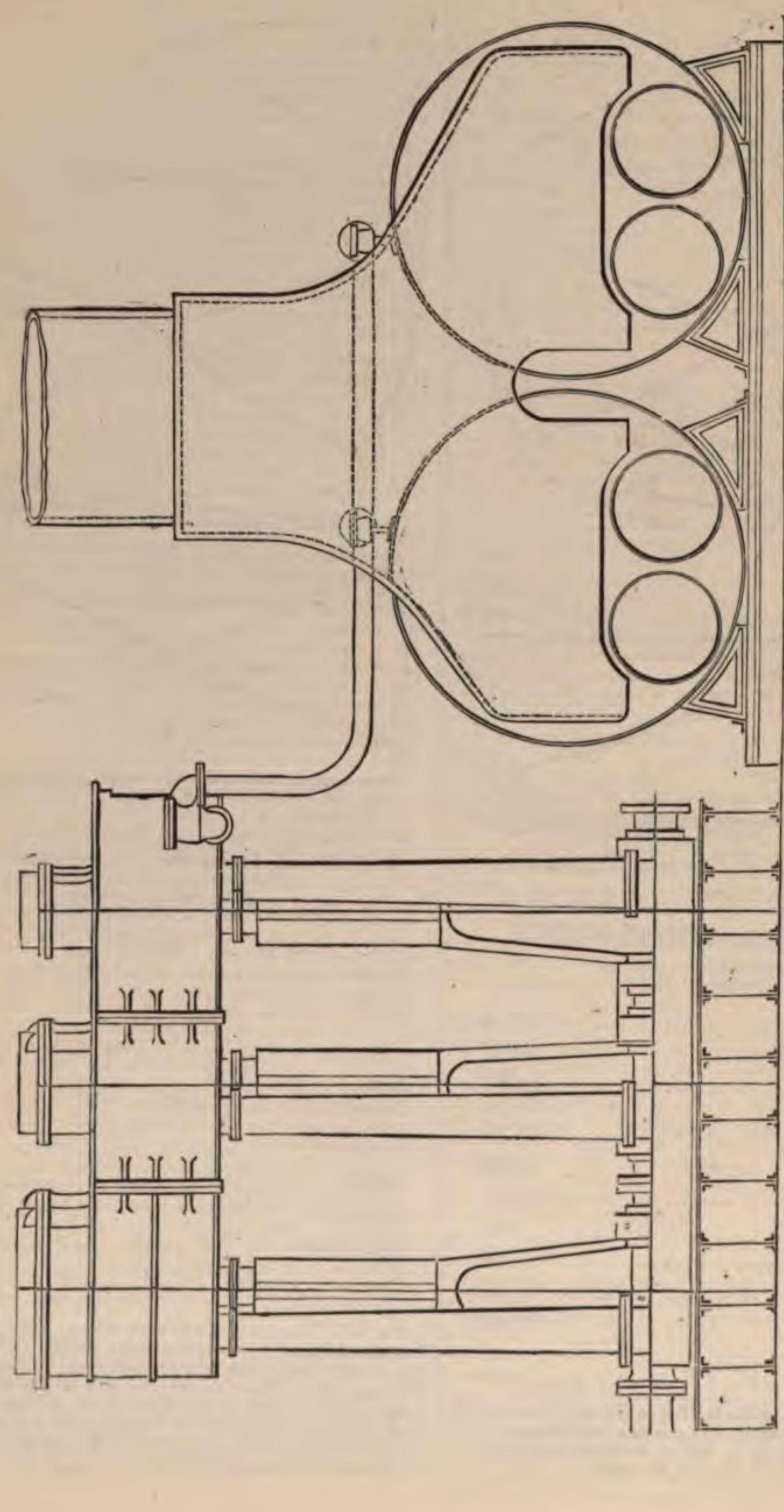


The following figures relate to the above sets :—

FULL POWER, I.H.P.

H.P.	...	...	...	...	...	403·73
M.P.	...	...	...	...	...	591·67
L.P.	...	...	...	...	...	499·84
			Total		...	1,495·24
M.P.	...	...	...	...	...	48·93
"	...	...	...	...	...	30·96
"	...	...	...	...	...	8·9
Steam	...	...	...	...	...	150
Vacuum ...	...	...	...	...	...	26
Revolutions	...	...	...	...	...	69

AN order has been placed with Messrs. Ramage & Ferguson, Leith, to build a new screw steamer, similar to, but larger than the *Malacca* (s.), built by them last year for the Singapore and Penang trade. The new steamer will be 216 ft. long by 30 ft. beam by 16 ft. depth, and will have powerful engines to drive her from 10½ to 11 knots per hour loaded. All decks and deck fittings will be of teak, and accommodation will be provided for a number of European and native passengers.



EARLE'S TRIPLE EXPANSION ENGINES.

(For description see p. 320.)

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—ED. M. E.]

LAUNCHES.—ENGLISH.

Lowther Castle.—On January 22nd, at Workington, a new ship was launched by Messrs. R. Williamson & Son, for the Lancaster Shipowners Company (Walter J. Chambers) of Liverpool. She is of a new and improved model, and her measurements are:—Length 267 ft., breadth, 39 ft., depth of hold 23 ft. 7 in.; carrying capacity, 2,900 tons; nett register tonnage, 1,875 tons. This vessel is being fitted with three masts, has large house on deck, full poop, and has been built of iron. Mrs. Walter Chambers christened the vessel the *Lowther Castle*. She will be commanded by Captain Charles Scarborough, late of the *Warwick Castle*, and is intended for the colonial and Californian trades, in which the other vessels of this fleet are usually engaged.

Adventure.—On February 4th there was launched from the shipbuilding yard of Messrs. John Readhead & Co., West Docks, South Shields, an iron screw steamer of the following dimensions, viz., 280 ft. by 38 ft. 9 in. by 18 ft. 6 in. She will carry a deadweight of 2,800 tons on Lloyd's freeboard. She is fitted with compound surface-condensing engines of 170 N.H.P., and two steel boilers also built by Messrs. Readhead. She is adapted for grain cargoes and the Mediterranean trade, and has been built to the order of Mr. Robert Harrowing, Whitby. The vessel was named the *Adventure* by Mrs. Trewent.

Maria P.—On February 4th there was launched from the yard of the Sunderland Shipbuilding Company, Limited, a finely modelled screw steamer, built to the order of Angelo Profuno, Esq., of Genoa. The vessel has been built under special survey to class 100 A1 Lloyd's, and her leading dimensions and particulars are: length 190 ft., breadth 27 ft., depth of hold 13 ft., with a 7 ft. awning deck in addition, three steam winches, steam windlass, and special appliances for the rapid loading and discharging of light cargoes, to meet the requirements of their Mediterranean trade. The engines are by the North Eastern Marine Engineering Company, of Sunderland, having cylinders 27 in. and 47 in. by 33 in. stroke. The vessel is built upon fine lines, and her saloon is handsomely fitted up for 20 first-class passengers. Upon leaving the ways, the steamer was gracefully named the *Maria P.* by Miss Lewis, of London.

Lindisfarne.—On February 4th Messrs. Richardson, Duck and Co. launched from their yard an iron sailing ship of the following dimensions: length over all, 264 ft.; breadth, extreme, 39 ft.; depth in hold, 24 ft. 3 in.; tonnage, gross, about 1,700 tons. This vessel, which has been built to the order of Messrs. John Lidgett & Sons, London, is classed 100 A1 at Lloyd's Registry, and has been built under special survey. She has a full poop, with accommodation for captain and officers, a topgallant forecastle, and a deckhouse fitted up for crew, galley, petty officers, etc. As the vessel was leaving the ways, she was christened the *Lindisfarne*, by Mrs. Miller, wife of Captain Miller, of Liverpool.

Cleveland.—On February 6th Messrs. W. Gray & Co. launched from their yard a fine steel screw steamer of the following dimensions: 285 ft. by 37 ft. 2 in. by 21 ft. 8 in., moulded to carry about 3,000 tons, built to the order of H. F. Pease, Esq., M.P., of Darlington, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type, with poop aft, containing handsome saloon and cabins for officers and a few passengers, long raised quarter-deck connected to bridge amidships. The bridge being carried over the machinery space, coal bunkers and main hatch, right forward to the foremast, thus covering in the lowest part of the vessel and adding greatly to her strength and stability. The crew are housed in the fore part of this extended bridge, which will add much to their comfort; the usual top-gallant forecastle is fitted forward, with Emerson, Walker & Co.'s patent combination capstan windlass. She has five hatches, four steam winches, two donkey boilers, and water ballast in double bottom under each hold, and is in every respect well equipped for general trading. The engines which are on the three cylinder triple expansion principle are being supplied by the Central Marine Engineering Co., West Hartlepool, to develop 900 I.H.P. and drive the ship 9½ knots per hour, on a daily consumption of ten tons of coal. The christening ceremony was gracefully performed by Miss Fell Pease, the vessel being named *Cleveland*.

Remus.—On February 6th Messrs. Cochrane & Co, launched from their shipbuilding yard, at Grovehill, an iron steam trawler, for Messrs. Pickering and Haldane, of Hull, which was named the *Remus*. She is a sister ship to the *Romulus*, is the second of Messrs. Pickering & Haldane's steam fleet, and is classed 100A at Lloyd's. Her dimensions are—105 ft. between perpendiculars, 20 ft. beam, 12 ft. moulded depth; she has rake stem, raised poop and forecastle, patent windlass (to be worked with messenger chain from steam winch), and will be fitted with all the latest improvements. She is to be supplied with engines of 45 N.H.P., by Messrs. C. D. Holmes & Co., Hull.

Barnsley.—On February 6th there was launched from Messrs. Head and Riley's shipyard at Hull, an iron screw steamer of the following dimensions:—Length, 60 ft.; breadth, 15 ft.; depth of hold, 8 ft. The vessel has been built to the order of the Hull and Barnsley Railway and Dock Company, for towing purposes. The vessel, as she left the ways, was christened the *Barnsley* by Miss Morgan. The *Barnsley* will be fitted with a patent windlass by Emerson, Walker & Co., and with Archer's patent steering gear. She will be supplied with powerful engines by Messrs. Cooper and Co., of Hull.

Andrina.—On February 6th there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt and Co., at Southampton, an iron sailing ship of about 2,700 tons nett register, and of the following dimensions:—Length, about 315 ft.; breadth, about 42 ft. 6 in.; depth of hold, about 24 ft. 6 in. The vessel has been built to the order of G. W. Roberts, Esq., of Liverpool. She has four masts, being full rigged on fore, main, and mizen, and fore and aft on jigger, and is built to class 100 A. The vessel has full poop for the accommodation of captain and officers, large deck house for crew, topgallant forecastle with lighthouses on same for bow lights, Emerson and Walker's patent windlass for working anchors, a powerful donkey engine, and all modern appliances for working vessel and cargo. During construction the vessel has been under the superintendence of Captain Charles Semple, of Liverpool. The vessel on leaving the ways was christened the *Andrina*, by Miss Mordaunt.

Fishtoft and Frampton.—On February 9th Earle's Shipbuilding & Engineering Co., Limited, launched from their yard at Hull two iron screw fishing trawlers, built by them for the Boston Deep Sea Fishing & Ice Co., Limited. The dimensions are 85 ft. by 19 ft. 9 in. by 10 ft., with flush deck aft, and small raised forecastle forward. They are built to Lloyd's 90 A1 class. The accommodation for captain and officers is aft, and that of the crew in the forecastle. The whole of the remaining space clear of engines is fitted for the storage of ice and fish. The vessels are ketch rigged, with pole masts and are fitted with a powerful steam winch of Earle's special design and make for working the haul gear. They will be fitted by the builders with direct acting inverted compound engines, having cylinders 12 in. and 22 in. diameter, and by 20 in. stroke, which will be supplied with steam of 90 lbs. pressure from a steel boiler fitted with one of Fox's corrugated furnaces.

Anson.—On February 17th this ironclad was launched from Pembroke Dockyard. The *Anson* is a twin-screw armourplated barbette ship, her principal dimensions being:—Length between perpendiculars, 330 ft.; extreme breadth, 68 ft. 6 in.; displacement, 10,000 tons. Her engines are of 7,500 H.P., and her indicated speed is estimated at 16 knots. Her belted armour will be 18 in. in thickness, and she will carry four 63-ton guns, six 6-in. broadside guns, ten Nordenfelts, and twelve 6-in. quick-firing guns.

Mandalay.—On February 18th, Messrs. Thomas Turnbull and Son launched a screw-steamer from their Whitehall Dockyard. As the vessel left the slipway she was christened the *Mandalay* by Miss Mildred Turnbull, daughter of Mr. Thomas Turnbull, junior. She is built to their own order. The following are the particulars of her construction:—Length, 258 ft.; breadth, 37 ft.; depth of hold, 18 ft. 6 in. Fitted with a short poop aft, raised quarter-deck, long bridge extending to foremast, and topgallant forecastle.

Accommodation for officers and engineers in after part of bridge, and for seamen and firemen in fore end of bridge. Engines by Blair & Co., of Stockton-on-Tees, on triple expansion principle, 150 H.P.; four steam winches by Roger; large donkey boiler by Riley Bros.; Emerson and Walker's patent windlass; Roger's steam steering gear (Pepper's patent), and all latest improvements. Her estimated carrying capacity is 2,350 to 2,400 tons, on a draught of 18 ft. 3 in. This is the first steamer built at Whitby fitted with the triple expansion engines, which are estimated to effect a saving of 25 per cent. in the consumption of fuel.

Prince of Wales.—On February 20th a splendid new paddle steamer was launched from the yard of the Barrow Shipbuilding Company, and on leaving the ways was named the *Prince of Wales* by Mrs. Armytage, wife of the deputy-chairman of the Lancashire and Yorkshire Railway Company. The new steamer has been built to the order of the Lancashire and London and North Western Railway Companies, and will be placed on the Fleetwood and Belfast royal mail station. She is 307 ft. long, 35 ft. beam, and 15½ ft. depth of hold. She will be fitted with two sets of engines, indicating 3,800 H.P.

LAUNCHES.—Scotch.

Steel Screw Steamer.—On January 21 Messrs. A. & J. Inglis launched from their yard at Pointhouse, Partick, a steel screw steamer similar in every respect to one launched by them in September last. The vessel's dimensions are as follows: length between perpendiculars, 335 ft.; breadth, moulded, 40 ft.; depth, moulded, 28 ft.; gross tonnage, 3,100. The vessel will be fitted with triple expansion engines of the most modern type, and of about 400 N.H.P.

Coomondery.—On February 5th, Messrs. T. B. Seath & Co., Rutherglen, Glasgow, launched a handsome steel screw steamer, named the *Coomondery*, which is intended for passenger and goods traffic between Sydney and Crolargatta, New South Wales. She is classed 90 A1 in Lloyd's Register, and measures 110 ft. by 20 ft. by 7 ft. 6 in. Messrs. Kincaid & Co., Greenock, are supplying her with compound surface-condensing engines of 40 N.H.P. which are expected to give a speed of 9 knots per hour. When completed she will be rigged as a sailing schooner and make the voyage to Sydney, *via* Cape of Good Hope, under sail alone.

Salamander.—On February 6th Messrs. A. G. Gifford & Co., Leith, launched a steam fishing vessel named the *Salamander*. She measures 70 ft. by 17 ft. by 8 ft. 6 in., and is intended for the deep-sea line and drift-net fishing. Messrs. Hawthorn & Co., Leith, are supplying the engines and boiler, which are expected to secure for the vessel a speed equal to nine knots per hour.

Mohawk.—On February 6th Messrs. James & George Thomson launched from their shipbuilding yard, at Clydebank, the twin-screw torpedo cruiser *Mohawk*, built for the British Navy. The vessel is the second of the *Scout* class, which was contracted for by the Messrs. Thomson in May last year. The *Mohawk* is 225 ft. long between her perpendiculars, or about 240 ft. over all. Her beam is 36 ft. and her depth 19 ft. Her displacement tonnage is 1,630 in what is called her normal seagoing condition, or 1,810 tons when fully equipped with all the coals and stores she can carry. The speed of the *Mohawk* is expected to be more than 16½ knots—how much more has never been publicly announced, but her builders are looking forward to attaining nearly 18 knots. She is propelled by twin screws, and has engines of 4,000 I.H.P. The boilers are four in number, of the navy type having tubes in the end of the furnaces. The total weight of the machinery is 350 tons, a weight which in an ordinary merchant steamer's machinery would only be capable of being accompanied by about 2,200 I.H.P. The gun armament of the *Mohawk* will consist of six 6-in. B.L.R., mounted on central pivoted carriages, and eight machine or rapid-firing guns. The torpedo armament will consist of ten tubes. The protection afforded to the guns and torpedo tubes is partly by means of a shield over the rear of the guns or torpedo tubes, to protect the man firing, and partly by means of plating 1 in. thick, on the ship's sides. The ship herself relies upon her very extensive system of subdivision for her protection, the part in the vicinity of water-line being particularly minutely divided. The coal bunkers are also arranged to give protection to the boilers, engines, and magazines, and the whole of the vital parts are covered by a water-tight deck a little below the water-line. The turning power of this vessel will be great, as she has very strong steam steering gear placed under water, and acting on a rudder of nearly 100 square feet of area. It is expected that the time to turn a complete circle with both screws going ahead will be as little as four minutes, and that the diameter of the circle will not exceed 300 yards. The amount of coal which the *Mohawk* can carry is sufficient to drive her at ten knots speed for 7,000 knots, or for about 2,500 knots at full speed.

Alcides.—On February 6th, Messrs. Napier, Shanks & Bell, Yoker, launched the *Alcides*, a spar-decked steel screw steamer of about 3,400 tons gross register, built to Lloyd's highest class, to the order of Messrs. Donaldson Bros., Glasgow, and which will form an important addition to their fleet. The dimensions are: length between perpendiculars, 340 ft.; breadth, extreme, 42 ft.; depth hold, 29 ft. 10 in. This vessel has been specially designed for the Canadian and American cattle-carrying trade, having the upper and lower 'tween decks fitted throughout with cattle stalls, and a partial double bottom for carrying fresh water for cattle supply; while a complete system of ventilation (Green's patent) has been provided. The hull is of the most substantial construction, with three steel decks, the outside plating being on the edge to edge principle, with outside covering plates; while the appliances and equipment are of the most efficient description, and specially adapted for the intended trade. Accommodation is provided for a limited number of first-class passengers amidships. The engines by Messrs. John & Jas. Thomson are of the triple expansion type of about 2,300 H.P. The vessel was named *Alcides* by Miss Alice Donaldson, of Bechwood House, and the owners were represented by Capt. Blair and Mr. A. Blair.

Highland Home.—On February 16th there was launched from the shipbuilding yard of Messrs. Ramage & Ferguson, West Pier, Leith, a three-masted steel barque of the following dimensions:—Length, 225 ft.; breadth, 37 ft.; and depth, 21 ft. The vessel has been built to the order of Messrs. Crane, Colville, and Co., of Glasgow, and is 1,300 tons nett register. Her masts and yards are of steel. The vessel was named the *Highland Home*. This is the fourth large sailing vessel built by Messrs. Ramage & Ferguson for the same owners.

Violet.—On February 18th there was launched from Messrs. Ramage & Ferguson's shipbuilding yard at Leith, an iron steam yacht trawler, of about 170 Y.M., built to the order of Lord Alfred Paget, Vice-Commodore of the Royal Thames Yacht Club. The new vessel presents some novel features in her construction, having a straight stem and great displacement, to enable her to carry heavy power within limited dimensions. The length over all is restricted to 105 ft., which will allow her to pass through the principal German and Dutch canals, breadth being 20 ft. and depth moulded 11 ft., the extreme draught of water being 8 ft. The engines are compound, and with cylinders 17 in. and 34 in. diameter by 22 in. stroke, and will give the yacht a high rate of speed. Powerful trawling gear and machinery is also fitted, suitable for fishing on the North Sea banks, and a separate hold is provided for the tackle and strong fish. The rig is that of a two-masted schooner with fore and aft canvas. All owner's accommodation is forward, while the officers and crew are berthed aft. On leaving the ways the yacht was named *Violet* by Mrs. Potter, wife of the captain.

LAUNCH—Irish.

Star of Austria.—On February 8th there was launched from the shipbuilding yard of Messrs. Workman, Clark & Co. (Limited), Belfast, a steel sailing ship for Messrs. J. P. Corry & Co., of Belfast. The following are the dimensions and other particulars of the vessel: length, 265 ft.; breadth, 38 ft. 7 in.; depth of hold, 23 ft.; gross tonnage, 1,750. She has been built to Lloyd's 100 A1 class, under special survey, but the scantlings are 10 per cent. over Lloyd's requirements, and the rivetting is also beyond Lloyd's. There are also several novelties in the equipment, one of which is a patent stopper on the windlass, and another is the fitting of the water-ports on what is known as the "balance-port" principle. These ports keep closed until the ship careens over to a considerable angle, thus preventing the flow of water through the lee ports, which is such a prominent objection to ports fitted the ordinary way. The crew are housed under the topgallant forecastle, the petty officers in a substantial iron house on the main deck amidships, and the boys in the poop. Cabin, officers' rooms, and staterooms are under the poop deck. The lower and top masts are in one, and are of steel, as are also the lower yards, lower and upper topsailyards, and bowsprit. Special care has been taken with the steel spars, and they are all well stiffened with angle bars. As the ship started to leave the ways the ceremony of naming her the *Star of Austria* was per-

formed by Miss Ada Corry, daughter of Mr. Robert Corry. The *Star of Austria* will be entirely completed in Belfast, and will be ready for sea in a few weeks.

LAUNCH—Norwegian.

Olaf Kyrre.—On February 8th, the *Olaf Kyrre*, built by Messrs. Martens, Olsen & Co., of Birgen, Norway, was launched. Her dimensions are: length over all, 206 ft.; extreme breadth, 29 ft.; depth of hold, 14 ft. 10½ in. She is intended for the tourist traffic on the North Cape. Her engines, built by the same firm, are triple-expansion, the first of this kind built in Norway. She will be the first vessel fitted with the electric light in Norway.

LAUNCHES.—German.

Ferdinand Fischer.—The Flensburg Shipbuilding Company launched on the 19th January, from their yard in Flensburg, a fine sailing ship, *Ferdinand Fischer*, built of iron, to the order of Mr. T. D. Bischoff, in Vegesack, near Bremen. This vessel is a sister ship to *Libussa*, which was built for a Hamburg firm, and which has now finished her first voyage to Singapore and back. The new vessel has the following dimensions: 258 ft. by 40 ft. by 23 ft. 9 in; 1,780 gross tonnage; 1st Division Veritas, and 100 A1 British Lloyd's. She will be full rigged, all masts, and nine yards of iron. In a full poop aft the cabin is arranged, and is finished in a very luxurious style. The christening act was performed by the intended wife of Mr. Bischoff, jun., Miss Danziger.

Victoria.—On the 28th January was launched from the Flensburg Shipbuilding Company, a passenger screw steamer, built of steel, for the trade between Föhr and Dagebüll. She has for this purpose a very shallow draft, 4 ft. 3 in., and a splendid passenger accommodation aft and forward, and will be fitted with strong towing arrangement, and a powerful engine, also built by the Flensburg Shipbuilding Company.

TRIAL TRIPS.

Coot.—On January 20th the fine screw steamer *Coot*, which has been built for the Cork Steamship Company, by Messrs. W. Gray & Co., and engined by the Central Marine Engineering Company, of West Hartlepool, went on her trial trip from that port to the Tyne. The principle dimensions of the vessel are:—length, 270 ft.; breadth, 37 ft.; depth, 18 ft. 6 in.; with 'tween decks laid, and having a carrying capacity of 2,650 tons. She is of the well-deck type, with poop aft, with handsome saloon and cabins for officers and passengers, long bridge carried forward of the foremast and which accomodates the crew. Fitted with four hatches, four winches, Clark Chapman's capstan windlass, and otherwise well equipped for general trading. The engines are on the triple expansion principle of the special type of the Central Marine Engineering Company, and similar in design to those of the s.s. *Enfield*, which have done excellent work on the first voyage to the Black Sea on a small consumption of coal. The dimensions of the engines of the *Coot* are—cylinders, 19½, 32½, and 53 in., with a stroke of 36 in. There are two single-ended boilers of Siemens-Martin mild steel, and fitted with Fox's patent corrugated furnaces. The working pressure is 150 lbs. per square inch. As the ship when taken on trial was very light, having no cargo whatever, it was impossible to make a speed trial of any value, but she ran about 10 knots per hour by the log against wind and tide, with considerable rolling at times. The chief object of the trial was to test the working of the engines under ordinary circumstances at sea, and it was the opinion of all on board that they sustained the trial in a most admirable manner. The engines were run at 70 revolutions per minute, and the long bearings for which the Central Marine Company are noted, were effectual in entirely preventing any sign of a tendency to "heating." In working into and out of port, Mr. Mudd's patent reversing gear acted in first-rate style, stopping or reversing the engines instantaneously. The trial was witnessed, amongst others, by Capt. Croft, the marine superintendent of the Company, and Mr. F. C. Kelson, consulting engineer for the Company, who have respectively superintended the vessel and engines during construction, also by Mr. Allison, superintendent for Mr. A. Stuart, of London; Mr. Cameron, Lloyd's surveyor of forgings; and Mr. Hector McColl, of Messrs. James Jack & Co., marine engineers, Liverpool, who was an invited guest. Captain Murrell represented the builders, and Mr. Thos. Mudd, the engineers. A comfortable luncheon was provided on board, at which the toast of success to the s.s. *Coot* was proposed and suitably responded to.

Amherst.—On January 22nd the screw steamer *Amherst*, constructed by Messrs. Blackwood & Gordon, Port Glasgow, and engined by Messrs. Bow, M'Lachlan & Co., Paisley, had her official trial trip on the measured mile at Skelmorlie. She measures 130 ft. by 25 ft. by 10 ft., and is a vessel of 250 tons gross. She carried 320 tons of dead-weight, and attained a speed of 9½ knots per hour. She is to be engaged in the general trade from Moulmein.

Maude.—On January 22nd the new steam launch *Maude*, belonging to the Sailors' Home, Dock Street, London Docks, underwent a successful trial trip. She is 55 ft. long, 11 ft. broad, and has a draught of about 4 ft. 9 in. She is a steel plated vessel, having compound surface condensing engines of the most modern description, the boiler being of the marine return tubular type. The builder is Mr. Edward Hayes, of Watling Works, Stony Stratford, who also constructed the engines, and the vessel has been built throughout under the survey of the Board of Trade and Lloyd's inspectors, who have expressed their entire satisfaction at the manner in which the work has been carried out. She will be stationed at Gravesend for the purpose of supplying seamen to those vessels which may leave London with some vacancies in their crews, so that delay will be prevented. A telegram addressed to the superintendent of the Sailors' Home at Gravesend will ensure the required men being provided by the time the vessel arrives off the town. The new branch Home adjoining the Custom House at Gravesend is being rapidly proceeded with, and is expected to be completed by March. There will be accommodation for 150 men, and all distressed seamen will be provided for.

Restitution.—On January 27th the screw steamer *Restitution*, belonging to Messrs. R. Conaway & Co., of Liverpool, of about 7,000 tons displacement, was tried on the measured mile when fully laden for Bombay. Although a heavy sea was running the mean speed was 9¾ knots. The steamer has been designed by Messrs. Ashlin & Ashbridge, of Liverpool, consulting engineers and naval architects, and built by Messrs. Wigham, Richardson and Co., with engines of their own make on Tweedy's patent triplex principle.

Penfeld.—On January 27th there proceeded from the yard of her builders, Messrs. Raylton, Dixon & Co., the steamer *Penfeld*, originally built for sale, and named *pro tem. Redistribution*, which has been purchased by Messrs. Chevillotte Frères, of Brest. Her leading dimensions are:—203 ft. by 28 ft. by 15 ft. 10½ in., with a carrying capacity of 1,140 tons, and she is fitted with engines of 100 H.P. by Messrs. Blair & Co., of Stockton. She is generally fitted as a first-class cargo boat, and attained on her trial trip a speed of 10½ knots.

Cabo Santa Maria.—On January 27th this steamer, which has been built by the same firm for Messrs. Ybarra & Co., of Seville, left the Tees on the same tide. Her dimensions are:—100 ft. by 19 ft. by 8 ft. 6 in., and she has engines of 25 H.P. by Messrs. J. P. Rennoldson & Sons of South Shields.

John Smith.—On January 28th the screw trawler *John Smith*, built by Mr. Liddell, Wallsend, to the order of Messrs. Smith, North Shields, was taken to sea on her trial trip. The vessel, which is built of wood, is of the following dimensions, viz.:—Length, 86 ft.; breadth, 18 ft.; depth, 10 ft. Her engines have cylinders 14 in. and 27 in. diameter, and 20 in. stroke. The weather was foggy, and a strong sea was running. Nevertheless, the trial was highly satisfactory. A speed of 10¼ knots was attained. The boat was tested in every way, and behaved admirably. She has been built with the view of remaining at sea during rough weather, and her trial showed that she will come up to the builder's and owners' expectations.

Anglian.—The Union Steamship Company's steamer *Anglian* having been supplied with new boilers, and her compound engines having been converted into triple-expansion engines by Messrs. Richardson & Sons, of Hartlepool, she has been lately taken out for trial at Stoke's Bay, and attained a mean speed of 13·1 knots on the measured mile, being 1½ knot faster than she accomplished on her original trial with compound engines in 1873. This higher speed is obtained with a considerably reduced consumption of coal.

It is stated that the Government has given an order to the firm of Sir William Armstrong & Co. for half a million's worth of shot and shell.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from December 31st, 1885.

16016 T. Hudson. Steam and other boilers.
16030 E. Edgar. Vertical steam boilers.
16040 Imray (A. Kerr, R. Costigan and W. Keys). Steam boiler low-water alarms.
16067 Barlow (J. Scott). Construction of steamers, sailing-ships, &c.
16083 T. G. Tagg. Chockhead or gunwale rowlock plate or attachment.
16094 C. N. Nixon. Fittings of rudders of boats, &c.
16095 M. H. Robinson. Regulating steam engines.
12 T. E. Mansfield. Rotary blowers.
29 W. Filshie. Metallic packing for pistons.
35 J. Maplesden. Propeller for boats and swimmers.
39 T. W. Worsdell. Starting-valve for compound engines.
41 Imray (W. C. Loe). Self-acting slide-gear for reciprocating engines.
44 R. Matthews. Governors.
56 G. E. Dorman. Electric governor.
93 T. Eddleston. Pumps for raising liquids.
110 W. D. Wansbrough and R. K. Evans. Low pressure steam motor.
130 G. H. Corliss. Steam boilers.
131 G. H. Corliss. Steam boilers.
134 C. S. Madan. Automatic feeding of steam boilers.
147 C. S. Madan. Injectors.
149 W. Begg. Furnaces.
158 J. Conlong. Metallic pistons.
165 J. Naysmith. Furnace bars.
168 R. Watkins. Vessels for subaqueous use.
183 F. White. Consuming smoke.
186 Newton (C. C. Worthington). Direct-acting steam engines.
187 J. Watts and H. E. Smith. Motor engines.
192 J. H. Hopwood. Steam boilers.
194 W. J. Fraser and F. S. Morriss. Multitubular steam boilers.
209 R. Hughes and W. Griffin. Ship or marine propulsion.
218 J. Anderson. Automatic valves.
220 E. Schmidt. Fire bars.
253 Turnbull (I. Plimmer). Propelling ships.
255 W. Gallon. Stone or concrete piers or breakwaters.
266 R. and W. Wainwright. Furnaces.
276 Turnbull (I. Plimmer). Steering ships, &c.
280 J. Fyfe. Steam boilers.
284 J. E. Holloway. Propelling boats and canoes.
285 P. Mutter. Obtaining and applying motive power.
286 C. N. Nixon. Fixing of rudders of ships, &c.
293 E. Tincknell. Steam engine valve gear.
298 C. T. Colebrook. Furnaces.
308 P. and S. Hoole. Steam boiler and other furnaces.
316 T. Mudd. Rotary engines.
340 H. C. S. Dyer. Compound armour plates.
341 S. W. Allen and A. Kellar. Extracting coupling bolts from the shafting of marine and other engines.
344 C. Wells. Construction of connecting-rods, ends and analogous parts of engines.
345 C. Wells. Stuffing box.
347 C. Wells. Water-gauge glass fittings.
369 Sir E. J. Reed, K.C.B. Ships of war.
373 H. S. S. Copland and J. C. Gilmour. Formation and construction of harbours, piers and breakwaters.
382 J. Watson. Burning oils or liquid fuel in steam boilers.
386 A. Dupassieux. Paddle-wheels.
390 C. Wells. Using torpedoes.
393 H. M. Bennett. Torpedoes.
395 O. Jones. Repeating rifles, &c.
401 J. Barrett. Propelling boats.
402 C. Little. Friction couplings.
403 J. L. Sampson and J. Hart. Furnaces.
404 J. L. Sampson and J. Hart. Feeding fuel to furnaces.
406 H. C. S. Dyer. Regenerative furnaces.
437 H. G. Huntington. Generating steam.
451 C. Becker. Chronometers.
456 G. M. Marchant. Steam and water valves.
459 L. C. Niebour. Ships' davits.

Correspondence.

LIST OF VESSELS LAUNCHED ON THE CONTINENT IN 1885.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—Referring to our note of this date we find that we have left out, by accident, one of the steamers delivered by us last year, viz., the steamer *Novogorod*, built of iron for a Company in the Caspian Sea, for carrying Naphtha in bulk. She was of 300 indicated H.P. and of the following dimensions :—length 150 ft., breadth 27 ft., draft 9 ft. 6 in., and with a depth of hold of 12 ft. 5 in. We are, dear Sir, yours truly,

ABO, *January* 23rd, 1886. WM. CRICHTON & CO.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

January 23rd, 1886.

Allan, George ..	1C	Leith
Armstrong, Thos.	2C	London
Brooke, George	2C	Cardiff
Buchanan, Jas.	1C	Glasgow
Clucas, John Hy.	2C	London
Doust, Richard	1C	,,
Durkee, James E.	2C	Cardiff
Edmond, James	1C	Glasgow
Felix, Hy. R. ..	1C	Cardiff
Gentles, Richard	1C	,,
Hopkins, Wm. T.	2C	,,
James, John E.	2C	,,
Kendal, Chas. E.	2C	,,
King, Leonard A.	1C	,,
Lewis, Thomas	1C	Liverpool
Macfarlane, A. P.	1C	Glasgow
Macfarlane, R. A.	2C	Belfast
Morris, John Hy.	1C	Cardiff
Nicol, Robt.	2C	Glasgow
Ramage, Chas. T.	2C	,,
Ray, Isaac	1C	London
Reid, Francis ..	2C	Leith
Reid, James....	2C	Glasgow
Rowe, Wm.	2C	Liverpool
Sim, Wm.......	1C	Glasgow
Stuart, Donald..	1C	,,
Symonds, Hy. G.	1C	Cardiff
Taylor, James ..	2C	Aberdeen
Thomas, Wm. Hy.	2C	London
Todd, Hugh....	2C	Belfast
Waddell, John T.	1C	Sunderlnd
Wheeler, Chas. R.	2C	London
Whyte, Wm. ..	2C	Dundee
Wilkes, H. J. ..	1C	Sunderlnd
Young, John ..	1C	Glasgow

January 30th, 1886.

Allan, N.	2C	Glasgow
Bardsley, Wm.	1C	Liverpool
Breach, Francis	2C	London
Burn, Thos.	2C	Sunderlnd
Carruthers, Thos.	2C	N. Shields
Corker, John ..	1C	Liverpool
Dixon, Joseph R.	1C	S. Shields
Dorward, J. R...	2C	Glasgow
Edwards, Joseph	2C	London
George, John W.	1C	Sunderlnd
Gillett, Joseph..	2C	London
Glaholm, Jas. ..	1C	Sunderlnd
Grayson, G. A.	2C	N Shields
Hooker, Francis	2C	London
Lawson, W. John	2C	,,
Leach, John	1C	Liverpool
Logan, John....	1C	Glasgow
McCall, Benj. ..	1C	,,
McLaren, R. N. B.	2C	,,
Paxton, John ..	2C	London
Phillips, John ..	1C	Aberdeen
Roberts, Chas. H.	2C	Hull
Stewart, Thos...	2C	Glasgow
Stewart, Wm. ..	2C	Dundee
Trail, Wm.	2C	Sunderlnd

February 6th, 1886.

Aitchison, Wm.	2C	N Shields
Akhurst, Wm. G.	2C	,,
Bleasedale, Robt.	2C	Liverpool
Bradley, Wm. ..	2C	,,
Brough, Alex. S.	1C	Leith
Brown, Joseph..	1C	Dublin
Christie, Wm...	1C	Leith
Christie, Wm. T.	1C	,,
Dorman, Wm. F.	2C	Liverpool
Hildreth, Jas. ..	1C	N Shields
Hughes, Wm. R.	1C	Liverpool
Jones, Edmund	2C	Bristol
Leighton, M. H.	1C	Liverpool
Lilienthal, John	1C	N Shields
McAlster, Geo. W.	1C	,,
McGill, Alex. F.	2C	Liverpool
McMillan, Donald	2C	Greenock
Morris, Jas.	1C	Leith
Pickard, Fred. F.	2C	N Shields
Roose, Wm.	E1C	Plymouth
Rycroft, Wm. ..	1C	Dublin
Stevens, Jas. ..	1C	Leith
Speirs, Robt. ..	2C	Greenock
Stewart, John ..	2C	Liverpool
Sykes, James E.	2C	,,
Thornton, John	1C	N Shields
Thorp, John ..	2C	,,
Vickers, Jacob ..	2C	Glasgow
Watters, John H.	1C	N Shields
Winpenny, Albt.	2C	,,
Withell, Fred...	2C	Plymouth

February 13th, 1886.

Bowle, Robt. ..	2C	Glasgow
Brown, Robt. ..	1C	,,
Campbell, John	2C	,,
Dunlop, Wm. ..	1C	,,
Elder, Jas.	1C	,,
Glasgow, W. C.	2C	,,
Greig, Geo. T...	2C	London
Hopkirk, Robt.	1C	Glasgow
Hughesden, Wm.	1C	London
Hunter, Wm. ..	1C	Glasgow
Ingram, Alex...	1C	,,
Jack, Wm.	2C	,,
MacIndoe, John	1C	,,
Marshall, Jas. R.	1C	,,
McGregor, A. ..	1C	,,
McKendrick, W.	1C	,,
Reid, John	1C	,,
Thatcher, Fred.	2C	London
Williamson, Jas.	2C	Glasgow